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EXPERIMENTAL ANALYSIS OF SMALL-GROUP PERFORMANCE EFFECTIVENESS:--ETC(U)
APR 82 H H EMURIAN, J V BRADY N00014-80-C-0467
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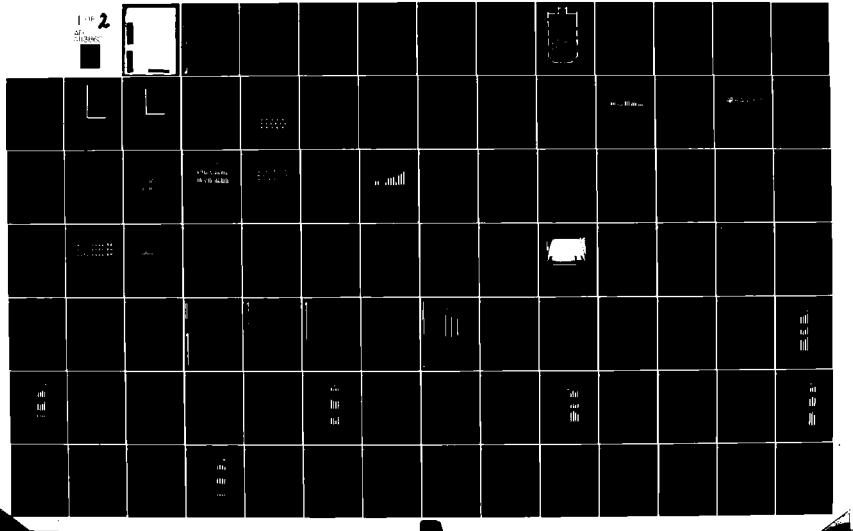

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20. ABSTRACT (Continue on reverse side if necessary and identify by block number) This report presents a summary of the background, objectives, methodological approach, and results of an ongoing research project devoted to the analysis of individual and team performance effectiveness under conditions of isolation and confinement during extended residences in a continuously programmed environment.		

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I. Background

Where the successful accomplishment of an organization's mission requires the coordinated contributions of two or more individuals collectively identified with the achievement of a common objective, the conditions for characterizing a team are operationally defined. For the most part, studies of group performance under operational, training, and simulation conditions which emphasize brief or extended exposure of team members to constant scenario environments have been limited by the constraints imposed on experimental interventions. Indeed, a review of the extensive literature in the area suggests that research on team performance effectiveness would be advantaged by the development and application of an effective methodology for extended-duration analyses of both the functional and topographic aspects of such situations under conditions which provide for operational task assessment and evaluation within the context of a comprehensive living and work setting (Hare, 1976; Thorndyke and Weiner, 1980).

Accordingly, in response to the growing recognition of the importance of developing technological guidelines related to (1) the impact of the type of mission, (2) the characteristics of group participants, and (3) the skill level of a novitiate participant as they affect a team's ability to accomplish mission objectives, a research project was undertaken to investigate performance effectiveness within the context of a programmed laboratory environment in which both interpersonal and work behaviors can be continuously monitored over extended time periods (e.g., days). Rather than simulating a targeted operational environment exhibiting a high degree of physical realism at the expense of flexibility of researchable problems to be addressed within such a

setting, the present laboratory facility was designed to address a broad range of performance related issues from the perspective of a functional analysis of performance effectiveness. This analysis emphasizes the assessment of relationships between antecedent conditions (e.g., membership turnover, training methods, etc.) and performance effectiveness which is afforded by the design features and measurement capabilities of such a "programmed environment."

The conceptual framework within which the research was undertaken reflects the influence of three prominent classes of interacting factors: (1) group composition, to include personnel or membership characteristics (e.g., number, training, personal history, etc.); (2) team resources, to include facilities and physical setting factors (e.g., hardware, living accommodations, communication networks, etc); and (3) group objectives, to include performance programs and incentive conditions (e.g., role assignments, pay-off matrices, etc.). These three broad categories of interacting factors are together representative of the range of theoretical and substantive issues addressed in previous team analyses and proposed for prospective group research agendas, with different investigations emphasizing one or the other class.

This report, then, describes the experimental methodology and representative results derived from ONR sponsored studies of such individual and group behavior conducted at The Johns Hopkins University School of Medicine under residential laboratory conditions in a programmed environment. The research methodology includes a laboratory environment which was intentionally

designed to facilitate the implementation of a behavioral program of activities which not only structures the team participants' use of available resources but also provides the framework for the observation and measurement of a comprehensive range of behaviors.

II. Research Accomplishments

A. Methods and Procedures

The research environment was designed and constructed for the conduct of small-group experiments over extended time periods within the context of a self-contained laboratory programmed for continuous residency by volunteer human subjects. Groups of male and female volunteers, recruited from local communities, served as experimental subjects in these studies. All subjects received psychometric test evaluation and interview assessment by a staff psychiatrist or psychologist as part of the screening procedure for acceptance as participants in the experiment. Each subject was fully informed about the research setting and about the research procedures involved. In addition, all subjects participated in several daily briefing sessions in the programmed environment prior to the start of an experiment to insure familiarization with the operational features of the laboratory. Following these briefings, but before beginning an experiment, a written informed consent agreement was signed and exchanged between the subjects and experimenters. In addition, a manual of instructions detailing the experimental procedures and environmental resources was provided to each subject for guidance throughout the experiment and retention thereafter for whatever reference purposes the participant may find necessary or desirable. With these procedures in effect, over 100 experimental

subjects participated in upward of 40 residential studies in the programmed environment without untoward occurrence.

The residential laboratory environment was composed of a complex of five specially-designed rooms joined by an interconnecting common corridor constructed within a wing of the Henry Phipps Psychiatric Clinic at The Johns Hopkins University School of Medicine. The overall floor plan of the laboratory and its arrangement within the external building shell are illustrated in Figure 1. The three identical private rooms (P - each 2.6 x 3.4 x 2.4 m) were similar to small efficiency apartments containing kitchen and bathroom facilities, bed, desk, chair, rug and other furnishings. The social living area (SL - 4.3 x 6.7 x 2.7 m) was equipped with tables, chairs, sofa beds, storage cabinets, and a complete kitchen facility. The workshop (WS - 2.6 x 4.1 x 2.7 m) contained benches, stools, storage cabinets, tools, and washer-dryer combination. A common bath (B, Figure 1) served the social living area and the workshop. Access to the exterior walls of the laboratory was provided by a 7.9 x 2.4 m corridor between the residential chambers and the external building shell which permitted transfer of supplies and materials through two-way storage facilities accessible from both sides. Remotely controlled solenoid locks on doors and cabinets throughout the environment provided for experimental programming of access to various facilities and resources, though at least one unlocked door in each compartment permitted departure from the laboratory at any time in case of emergency and preserved the right of subjects to terminate their participation in an experiment at any time.

The electromechanical control devices throughout the environment were interfaced with a computer system located in an adjoining laboratory support facility which provided for experimental monitoring, programming, recording, and data analysis. The computer was linked to a Cathode Ray Tube (CRT) Display

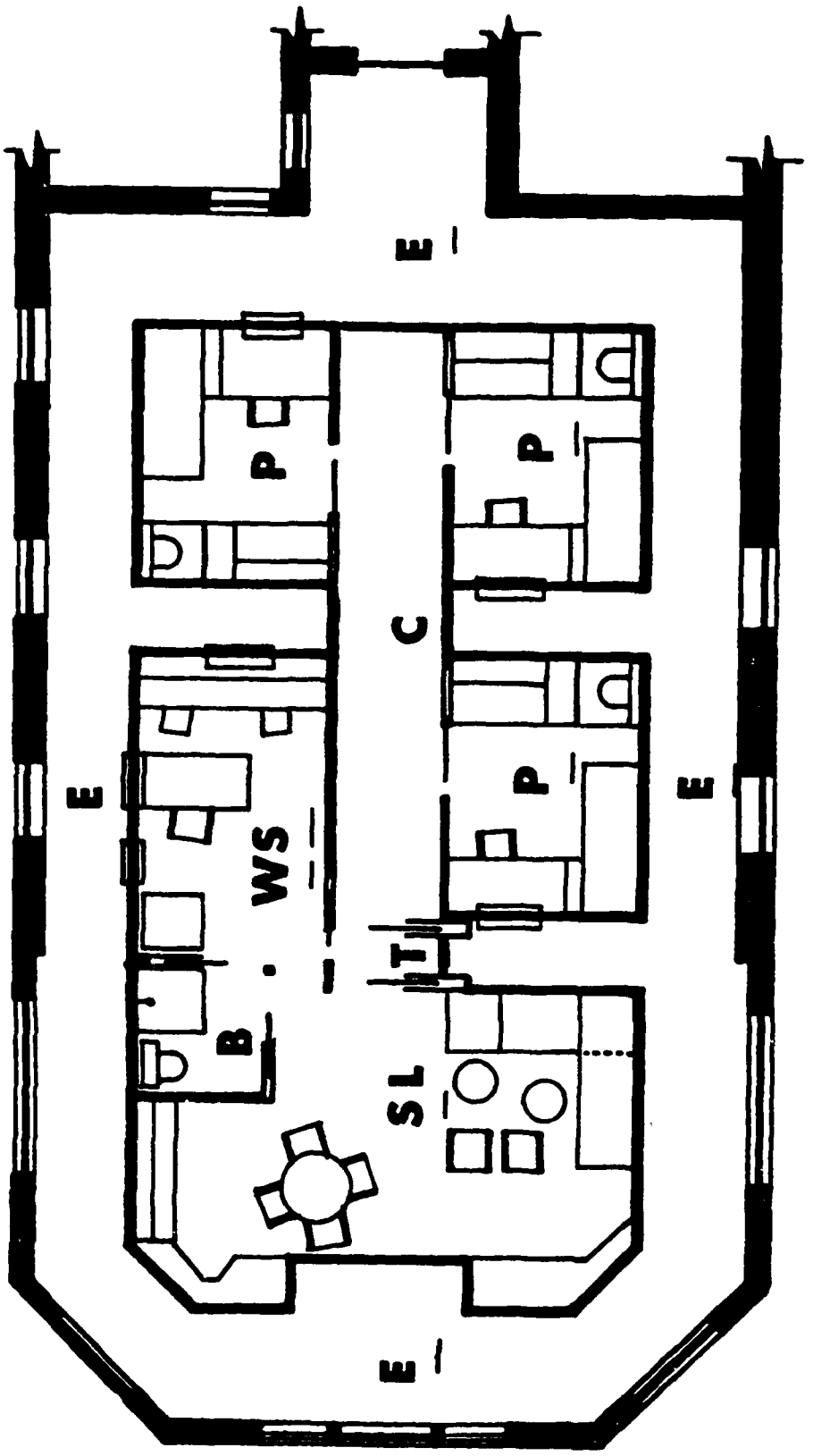
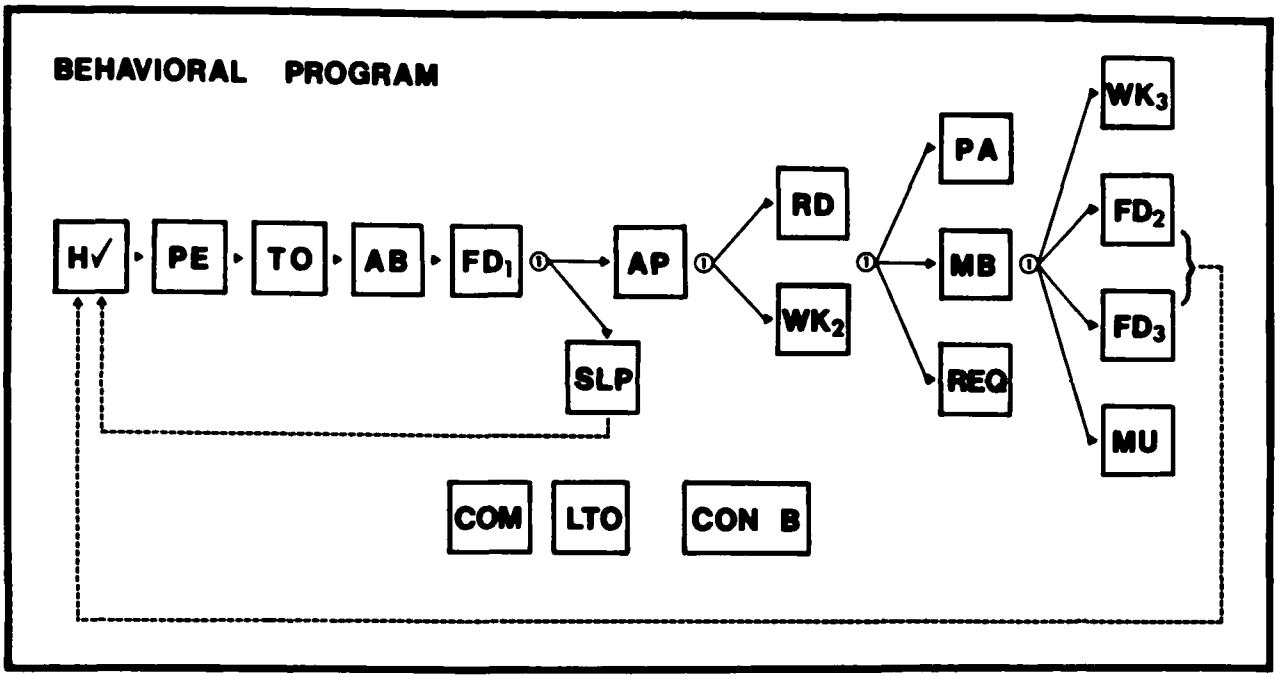


Figure 1. The overall floor plan of the laboratory and its arrangement within the external building shell.

Device within each of the private rooms of the residential laboratory, and an alpha-numeric keyboard with each display unit provided for direct communication with the system control. The communication panel in each individual chamber incorporated the CRT unit and also included both a telephone intercom for exchanges between subjects within the environment and a cassette tape player. Audio and video equipment in each of the residential chambers permitted continuous monitoring during conduct of an experiment.

Behavioral programming procedures were developed to establish and maintain stable performance baselines as well as to provide for systematic experimental manipulation of performance interactions during extended residential studies in the laboratory environment. A behavioral program was defined by: (1) an array of activities or behavioral units, and (2) the rules governing the relationship between these activities. Figure 2, for example, illustrates diagrammatically the fixed and optional sequences which characterized a typical behavioral program used to establish baseline performances for these experiments, as well as the array of component activities which made up such a program. Variations in this program as required for specific experimental studies will be described below. Each box in the diagram represents a distinct behavioral unit and performance requirement, with progression through the various activities programmed sequentially from left to right. Regardless of the fixed or optional sequence selected, all behavioral units were scheduled on a contingent basis such that access to a succeeding activity depended upon satisfaction of the requirement for the preceding unit.

Beginning at the far left, the fixed activity sequence was composed of all activities between and including Health Check (H✓) and Food One (FD1). The Health Check activity required the subject to determine temperature, pulse, and weight, and to fill out subjective status questionnaires. He then completed the



INVENTORY OF ACTIVITIES

NOTATION	FULL NAME	BRIEF DESCRIPTION
H✓	HEALTH CHECK	TEMPERATURE, PULSE, WEIGHT, STATUS REPORT
PE	PHYSICAL EXERCISE	300 CORRECT PRESSES ON AUTOMATED TASK
TO	TOILET OPERATIONS	USE OF PRIVATE BATHROOM AND CONTENTS OF DRAWER CONTAINING TOILETRIES, CLEAN CLOTHING
AB	AUTOGENIC BEHAVIOR	RELAXATION EXERCISES ON TAPE
FD1	FOOD ONE	TWO SELECTIONS FROM A LIST OF LIGHT FOODS
SLP	SLEEP	UNLIMITED USE OF BED
AP	ARITHMETIC PROBLEMS	100 CORRECT SOLUTIONS OF ARITHMETIC PROBLEMS
RD	READING	ACCESS TO BOOK
WK2	WORK TWO	PROBLEMS, EXPERIMENTS, ASSEMBLY PROJECTS
PA	PUZZLE ASSEMBLY	ASSEMBLE A PUZZLE
MB	MANUAL BEHAVIOR	ACCESS TO ART MATERIALS
REQ	REQUISITION	EARN DELAYED DELIVERY OF TREATS OR REPLENISHMENT OF CONSUMABLES
WK3	WORK THREE	SOCIAL, ACCESS TO COMMUNAL WORKSHOP
FD2	FOOD TWO	PRIVATE MAJOR MEAL
FD3	FOOD THREE	SOCIAL, MAJOR MEAL IN RECREATION ROOM, GAMES
MU	MUSIC	5000 LEVER PRESSES TO EARN A CASSETTE TAPE
COM	COMMUNICATION	ACCESS TO INTERCOM
LTO	LIMITED TOILET OPERATIONS	ACCESS TO ESSENTIAL TOILET FACILITIES
CON B	CONDITION B	CHANGE IN PROGRAM CONDITION

Figure 2. A typical behavioral program governing the sequential and contingent relationships of activities.

following activities in the order displayed: Physical Exercise (PE), requiring 300 correct responses on an automated exercise task; Toilet Operations (TO), providing access to the private-room bathroom and drawers containing towels, toiletries, and a vacuum cleaner; Autogenic Behavior (AB), in which the subject followed taped relaxation instructions; and Food One (FD1), in which the subject was permitted to select two items from a presented list of 10 light foods such as coffee, tea, soup, cereal, etc.

When Food One was completed, the subject was eligible to select one of the following two activities: Arithmetic Problems (AP), requiring 100 solutions on a series of mathematical problems presented on a cathode-ray display screen and keyboard; and Sleep (SLP), providing access to the bed for an unlimited time period of at least 30 minutes. If the subject selected Sleep, he or she was required to return to the Health Check activity and fixed activity sequence at the completion of Sleep. This minimum recycling sequence was designed to maintain and assess the subjects' health if they were otherwise indisposed to engage in the broader selection of opportunities.

The optional activity sequence commenced with the choice of Arithmetic Problems instead of Sleep. At the completion of Arithmetic Problems, the subject was eligible to select one of the following two activities: Reading (RD), providing at least 30-minutes' access to books contained within a drawer; or Work Two (WK2), in which the subject completed in private various problems, experiments, or assembly projects presented in a drawer. When the selected activity was completed, the subject was eligible to select one of the following three activities; Puzzle Assembly (PA), requiring the subject to assemble a puzzle presented in a drawer; Manual Behavior (MB), providing at least 30-minute's access to art supplies contained in a drawer; or Requisition (REQ), allowing the subject to press a lever to earn at least one but not more than 30 points exchangeable for treats, such as soft drinks and pastries, or for

consumables, such as soap and toothpaste. On completion of the selected activity, the subject was eligible to select one of the following four activities: Work Three (WK3), providing at least 30 minutes in the workshop by one, two, or three subjects to complete assembly projects and maintenance chores; Food Two (FD2), requiring at least 30 minutes and providing the subjects with a major meal to consume in the private room; Food Three (FD3), providing at least 30 minutes in the recreation room by one, two or three subjects to consume a major meal and to play games; or Music (MU), allowing the subject to press a lever to earn a cassette tape that could be played at any time. Once a subject had completed his choice among these four activities, he returned to Health Check and the fixed activity sequence, indicated by the dotted line. The optional activity sequence allowed the subject flexibility in the selection and arrangement of activities, both individual and social.

At the bottom of the diagram are two activities with more general rules. The Limited Toilet Operations (LTO) activity, which allowed access to essential toilet facilities, was the only activity that could be selected at any time. The Communication (COM) activity allowed access to the intercom for intersubject communications. A subject was permitted to use the intercom to initiate or answer a communication only if he were between any two program activities. Although the Communication activity was available between any activities, an actual conversation required at least two subjects' simultaneous presence within the Communication activity. Conversing subjects, however, whether in pairs or all three at once, could be located at different sequential positions within the behavioral program. For example, a Communication and conversation might occur when one subject was between Autogenic Behavior and Food One, and another subject was between Manual Behavior and the last column of activities, and so on.

The CON B notation at the bottom of the diagram refers to a program change determined by the requirements of a specific experiment, as described below. A manual of instructions detailing the program and use of environmental resources was contained in each room of the environment. An error in following the behavioral program caused a five-second blackout. Subjects followed the behavioral program throughout the periods of residence, and pairs of research assistants monitored the experimental environment continuously with audio and video equipment located, with the subject's awareness, in each room of the environment.

Appendix A provides a more detailed description of the methodology used in the research to be summarized in the following sections of this report.

B. Research Findings

1. Parametric Studies

Initially, preliminary environmental habitability and performance programming studies (Brady, et al., 1975) were conducted with groups of two and three subjects during intervals of continuous residence in the research environment ranging from 2 to 16 days. Only minimal (and basically biological) activity sequences (i.e., eating, sleeping, group recreational interactions, etc.) were required during the briefer exploratory periods, with gradual extensions of continuous residential periods from 1 to 3, and then to 10 days, introducing more complex programmatic sequencing of performance activities with successive groups. Figure 3, for example, shows the high and relatively stable percentage of time spent in social activities for two subjects over the course of such a 10-day residential study, and Figure 4 reflects the high degree of intersubject program synchrony evidenced by the percentage of time the same two subjects were engaged in identical individual activities or were simultaneously engaged in different individual activities within the same column of optional

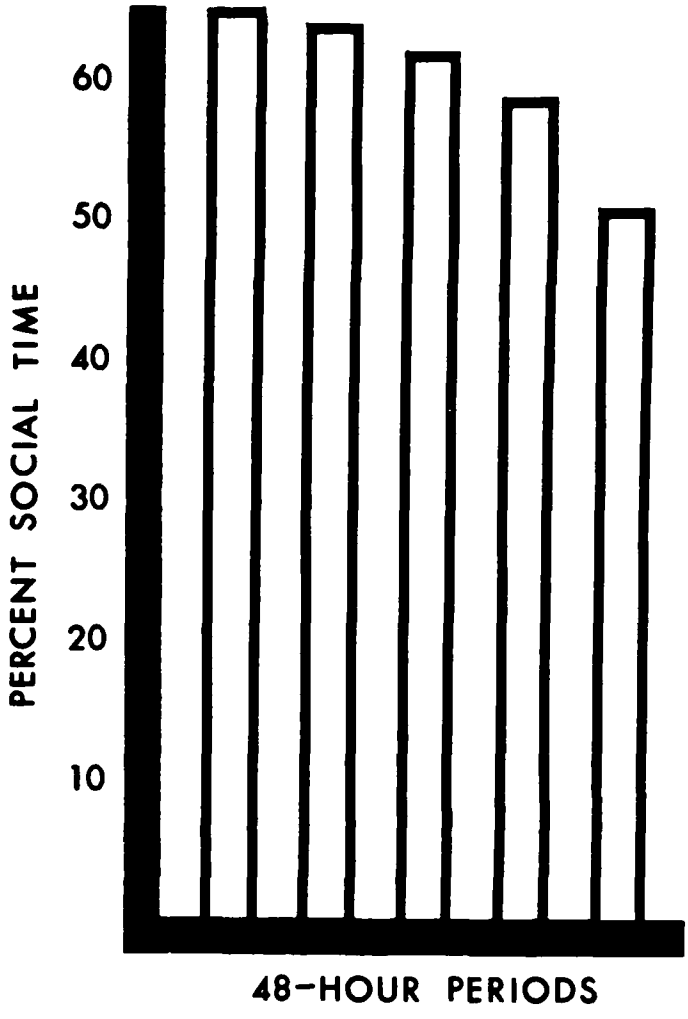


Figure 3. Percent of time that subjects were engaged in social activities, across consecutive 48-hour periods of the experiment.

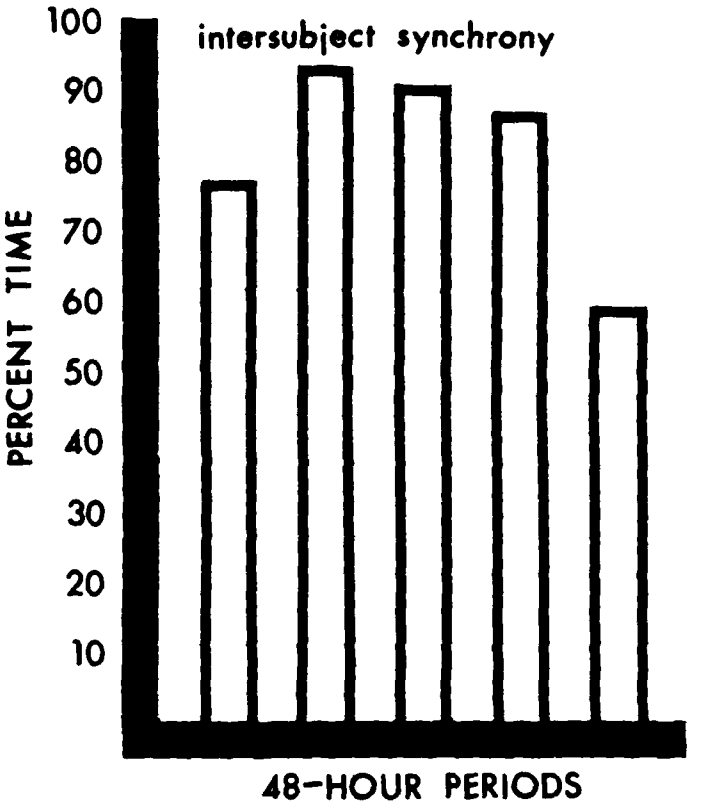


Figure 4. Percent of time that subjects were synchronized with respect to their positions in the behavioral program across consecutive 48-hour periods of the experiment.

activities during the 10-day study period.

Based upon the finding that these small groups could not only be maintained under stress-free living conditions for extended periods of continuous residence in the experimental environment, but that the sequential contingency performance program developed in the course of these investigations was supportive of both individual and group behavioral activity (Emurian, Bigelow, Brady & Emurian, 1975), a series of program parameter studies was undertaken. The major purpose of these experimental manipulations was to focus on the temporal determinants of behavioral interactions in the programmed environment under conditions of performance schedule "pacing" (i.e., imposed delays between activities) and upon extensions of continuous residential periods in the laboratory up to several weeks. Figures 5 and 6, for example, illustrate some of the more interesting incidental observations on orderly changes in sleep-wake cycles during one such residential study with two subjects. As shown in Figure 5, there was a progressive increase in the duration of successive wake periods with little or no systematic change in the duration of successive sleep intervals (Figure 6), resulting in a complete 12-hour reversal of the sleep-wake cycle over the 7-day residential period.

2. Group Cohesion Studies

The major findings of these early studies emphasized the differential importance of selected program components (e.g., social activities) in maintaining individual and group performance and the sensitivity of behavioral interactions to experimental manipulations (e.g., program condition changes and reversals) over the course of extended residential periods. Consequently, a series of more systematic and extensive studies (Emurian, Emurian, Bigelow & Brady, 1976) was undertaken to focus upon the motivational and emotional effects of varying social interaction conditions in five groups of three subjects for

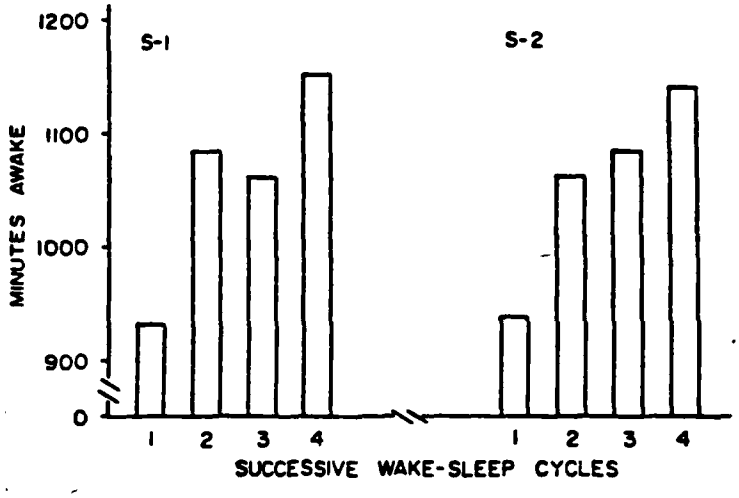


Figure 5. Minutes awake during successive wake-sleep cycles. Only consecutive waking periods bound both before and after by sleep are presented.

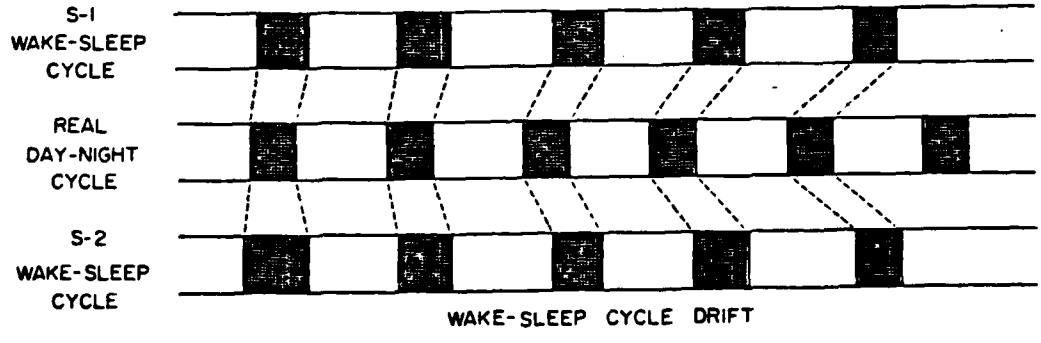


Figure 6. Successive wake and sleep durations across the temporal course of the experiment for both subjects.

periods up to 15 days of continuous residence in the programmed environment. The scheduled arrangement of required and optional private and social activities described above determined the individual and group baseline performances upon which the experimental social interaction conditions were superimposed. A cooperation condition (C) was in effect when all three subjects were required to select simultaneous access to a group area before it became available for use. This condition was programmed by requiring that either of two activities within the group area (i.e., FD3 or WK3) was accessible only when all three subjects selected it together. Typically, subjects would use the intercom several activities in advance to plan subsequent selection of a social activity. They would then pace their individual schedules accordingly to arrive at the choice point in the program at approximately the same time. Subjects almost always used the intercom immediately before FD3 or WK3 to insure that their schedules and choices were synchronized. Under the cooperation condition, subjects were also required to leave the group area at the same time, returning to their private rooms one after another.

In contrast to the cooperation contingency, a non-cooperation condition (NC) was in effect when FD3 or WK3 was accessible singly, without regard to the other subjects' activity selections. For example, a single subject could select FD3 or WK3 at the choice point and could then leave his private room immediately and enter the chosen group area even though the other subjects were engaged in private activities. Of course, the other subjects could also have access to the same group area at the same time, but they were not required to enter and leave together.

For Groups 1 through 5, these two conditions were investigated in the following order and number of successive days under each condition, respectively: C-NC-C (days: 4, 3, 3); NC-C-NC (days: 5, 5, 5); NC-C-NC (days:

4, 3, 3); C-NC-C (days: 4, 3, 3); and C-NC-C (days: 4, 3, 3).

A time sampling procedure was employed to monitor the occurrence of social interactions during triadic episodes. When all three subjects occupied either the social living area (FD3) or the workshop (WK3), 10-second observational samples were taken on a variable-interval schedule averaging eight minutes between samples. During each 10-second sample, each subject was rated independently on a "yes/no" dichotomization reflecting the presence or absence of a social interaction. A subject was rated as having exhibited a social interaction if he engaged in any of the following four behaviors: (1) any vocal utterance, (2) participation in social games, (3) physical contact with another subject, or (4) handling materials between subjects. The high degree of inter-rater reliability upon which these social interaction measures were based was reflected in a coefficient of correlation well above +.90.

The results of these experiments showed clearly that the systematic effects of such contingency management procedures could be discerned not only upon the social behavior of the group but also upon collateral individual behaviors which characterized performances within the continuously programmed environment. Enhanced levels of intersubject program synchronization (Table 1) and intercom frequencies (Table 2) were accompanied by comparable increases in the magnitude of triadic episodes during the cooperation condition. Not only the percent of total time spent in triadic social activities (Table 3), but the durations of triadic episodes (Table 4), combined with corresponding social interaction measures (Table 5), suggested a potentially important consequence of cooperation contingencies in maintaining more durable social interactions when continued access to the group areas accrued primarily as a result of the frequency of social interactions.

Cooperation contingency effects on triadic conditions would seem to be of

Table 1
Percent of Time in Intersubject Program Synchronization

Group	Conditions[a]			
	C	NC	C	NC
1	55.5	18.6	47.4	—
2	—	24.4	27.9	20.0
3	—	35.5	48.7	54.6
4	73.8	45.7	67.8	—
5	64.6	49.3	70.8	—

[a]C=cooperation condition, NC=non-cooperation condition.

Table 2
Mean Daily Intercom Selections

Group	Subject	Conditions[a]			
		C	NC	C	NC
1	1	9.3	5.7	6.0	—
	2	5.5	0.3	2.7	—
	3	9.3	5.0	5.3	—
2	1	—	4.0	3.4	2.2
	2	—	2.4	2.2	0.8
	3	—	2.8	2.4	2.0
3	1	—	4.0	8.3	2.3
	2	—	3.8	8.0	3.7
	3	—	3.5	5.3	2.3
4	1	6.5	1.7	5.0	—
	2	5.8	3.3	4.7	—
	3	5.8	2.0	4.0	—
5	1	2.5	1.0	1.3	—
	2	2.5	1.7	1.3	—
	3	2.5	1.3	1.7	—

[a]C=cooperation condition, NC=non-cooperation condition.

Table 3
Percent of Time in Triadic Episodes

Group	Conditions[a]			
	C	NC	C	NC
1	25.8	12.5	34.9	—
2	—	4.0	8.8	1.9
3	—	21.2	17.9	14.1
4	28.2	13.1	21.4	—
5	19.8	5.8	24.2	—

[a]C=cooperation condition, NC=non-cooperation condition.

Table 4
Mean Triadic Durations (Hours)

	FD3				WK3			
Group	Conditions[a]				Conditions[a]			
	C	NC	C	NC	C	NC	C	NC
1	3.2	2.3	5.4	—	2.6	none	3.6	—
2	—	4.8	4.6	1.2	—	none	1.4	none
3	—	4.2	5.8	4.5	—	1.8	2.3	none
4	4.7	2.7	3.4	—	2.8	1.3	1.9	—
5	3.6	1.3	5.8	—	2.2	0.4	none	—

[a]C=cooperation condition, NC=non-cooperation condition.

Table 5
Proportion of Samples Where Social Interactions Occurred During Triadic FD3 Episodes

Group	Subject	Conditions[a]			
		C	NC	C	NC
3	1	—	.842	.854	.838
	2	—	.833	.878	.897
	3	—	.783	.805	.779
4	1	.774	.834	.609	
	2	.788	.750	.731	—
	3	.688	.750	.475	—
5	1	.634	.654	.420	—
	2	.653	.615	.420	—
	3	.703	.269	.375	-

[a]C=cooperation condition, NC=non-cooperation condition.

particular significance when considered in light of group fragmentation effects observed during non-cooperation conditions. The distribution of dyadic percent times into two high-pairing subjects and one low-pairing subject within the groups, illustrated in Figure 7, suggests development of a two-person in-group and a relative social isolate during the non-cooperation condition. And the extent to which motivational and emotional interactions participated in the social contingency effects is suggested by the results observed with the very first group when the change from cooperation to non-cooperation conditions was programmed. Within minutes after the condition change was introduced during the course of a triadic social episode at the end of day 4, Subject 2 became involved in an altercation with the other two subjects and abruptly returned to his individual chamber. During the ensuing three days of the non-cooperation condition, Subjects 1 and 3 continued to engage in frequent dyadic social interactions which excluded Subject 2, as illustrated in the left-hand segment of Figure 7. More importantly, the performances of Subject 2 with respect to the maintenance of "housekeeping" chores in his individual chamber deteriorated and, significantly, the error rate reflected in his "private arithmetic" performances increased dramatically, as shown in Figure 8, during the period immediately following the disruptive emotional interaction (i.e., arithmetic activities 14, 15, and 16). The interacting motivational effects of delayed progress through the program can, however, be presumed operative in the equally dramatic decrease in error rate which occurred even before termination of the non-cooperation condition (i.e., arithmetic activities 17 and 18). In contrast, Figure 9 illustrates the weakening disposition of Subject 2 to engage in less consequential "hobby" activities as reflected in the progressive shrinkage of a series of pot holders produced in the course of several successive MK3 ("workshop behavior") selections during this same experiment.

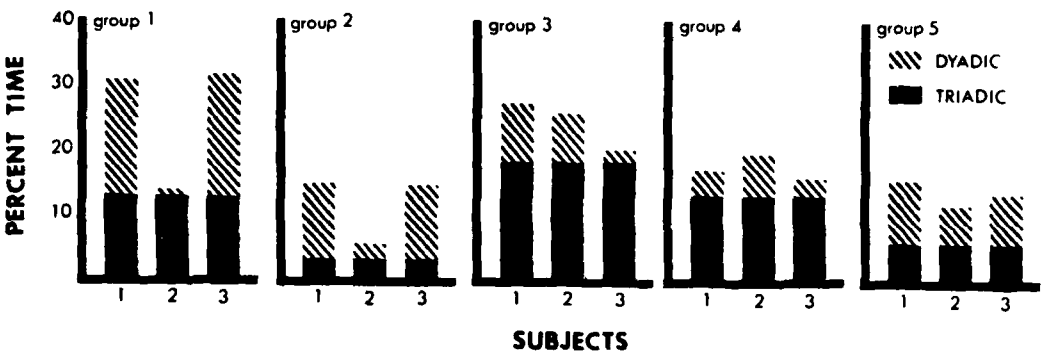


Figure 7. Percent of total time within noncooperation (NC) conditions that all subjects in each group spent in triadic and dyadic episodes totalled across FD3 and WK3 activities. Where two NC conditions occurred for Groups 2 and 3, data have been combined across conditions.

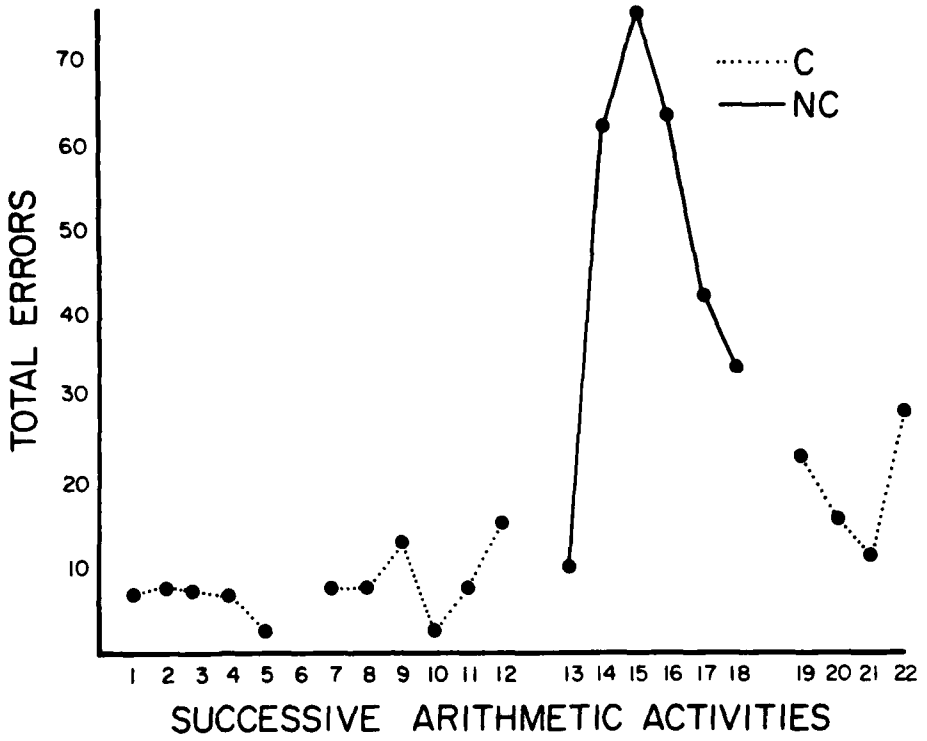


Figure 8. Total errors committed by Subject 2 on an arithmetic task, requiring 100 correct solutions to complete, across successive selections of the arithmetic task activity.
C=cooperation condition, NC=non-cooperation condition.

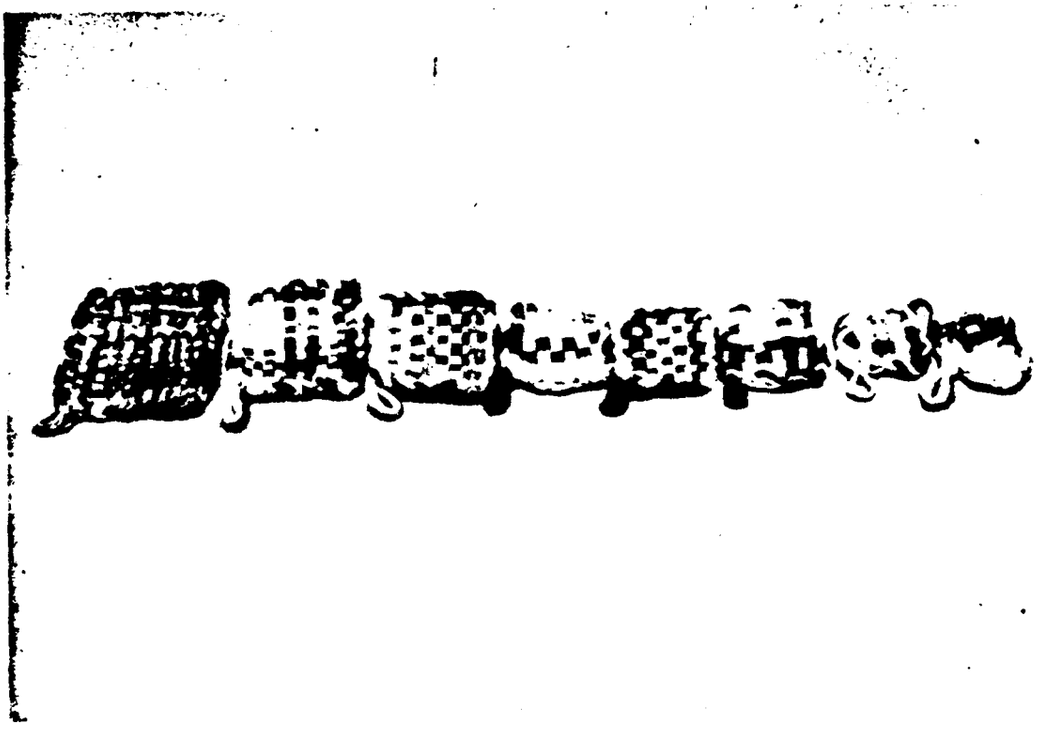


Figure 9. The progressive "shrinkage" of a series of potholders produced by the subject in the course of several successive WK3 activities.

A more extended analysis of such social interaction contingency effects was undertaken with four additional groups of three male subjects who participated in a series of 10-day experiments to evaluate further the effects of subject pairing on individual and social behavior (Emurian, Emurian, & Brady, 1978). In addition to the triadic contingencies studied previously, dyadic contingencies were scheduled when simultaneous occupancy of a group area was permitted to any combination of two, and only two, subjects. Solitary access to group areas also was permitted to parcel out the reinforcing effects of social episodes, independently of those attributable to the accessibility of a larger space. Additionally, included in the behavioral program was a group task that allowed individual contributions to a group criterion that had to be satisfied before triadic or dyadic episodes could occur. This Group Arithmetic Problems (GAP) activity could be selected immediately following the completion of Private Arithmetic Problems (AP). During the GAP activity, the subject could work privately on the problems to contribute to a group criterion of 600 solutions. This criterion had to be satisfied before WK3 or FD3 could be selected by more than one subject, and a counter, present in each private room, showed cumulative contributions to this criterion by all subjects combined. Once a subject had selected GAP, he was required to solve at least one problem correctly before selecting another activity. The GAP task was included to determine the extent to which responding could be maintained by access to different social situations (i.e., triadic or dyadic).

A triadic program condition (T) was in effect when either of two social activities within group areas (i.e., WK3 or FD3) was accessible only when all three subjects selected it together. During this condition, however, 600 counts on the group task were required before either WK3 or FD3, permitting subjects to leave their private rooms and enter the appropriate group area, could be

selected by a triad.

In contrast to the triadic condition, a dyadic program condition (D) was in effect when WK3 and FD3 were accessible for social activities by any combination of two, and only two, subjects. As in the triadic condition, 600 counts on the group task were required before WK3 or FD3 could be selected by a dyad. In both conditions, subjects were required to enter and leave the group areas at the same time. Once a group area was occupied by a dyad, access to that area by the third subject was denied until the activity was terminated by the dyad.

For Groups 1 through 4, the dyadic and triadic conditions were investigated in the following order and number of successive days under each condition, respectively: T-D-T (days: 4, 3, 3); D-T-D (days: 4, 3, 3); T-D-T (days: 4, 3, 3); and D-T-D (days: 4, 3, 3). These sequences were used to control for the effects of the order in which the conditions were presented. For Groups 1 and 2, there was no upper limit on the durations of WK3 and FD3, but for Groups 3 and 4, a three-hour upper limit was in effect. Throughout social episodes in the recreation room (FD3), 10-second observational samples were taken on a variable-interval schedule averaging five minutes between samples. During each observational sample, the subjects' identification numbers (i.e., 1, 2, and 3) were recorded directly on a schematic diagram of the room by two independent observers, giving the subjects' exact location in the room and their proximity to one another. On the basis of these observations, a social distance scale was computed for each subject reflecting his physical proximity to the other two subjects during triadic social episodes. A given subject's score for a single observational sample was the sum of the distances between himself and the other two subjects. The recordings upon which the social distance scores were based showed high inter-rater reliability (correlation = +.96).

The results of this experiment showed that the status of a closed

three-person social system changed when social opportunities were limited to dyads as compared to the triad. Under such dyadic conditions, durations of social contacts were briefer (Figure 10), and performance schedules drifted apart as reflected by decreased levels of harmony in the selection and completion of behavioral program activities (Figure 11). Additionally, daily response outputs on a task having social consequences (GAP) were more often omitted during dyadic conditions (Figure 12). These results illustrate the group fragmentation effects previously observed during a non-cooperation condition (Emurian, Emurian, Bigelow & Brady, 1976) in a situation in which triadic social interactions were prohibited, rather than being optionally available.

Although division of group members occurred in the non-cooperation condition of the previous experiments, all subjects continued to have both dyadic and triadic social interactions, and consequently, no subject was ever completely isolated from group activities. In the present experiment, however, group fragmentation effects were stronger during the dyadic condition than observed under the previous non-cooperation condition. Under dyadic conditions, three of the four groups in the present study had a lone member who failed to have any direct social contact for several successive days. These differences may be attributable, at least in part, to the more demanding contingencies that were in effect for social contact under dyadic conditions, where responding was required on the group task, and two subjects had to cooperate in the choice of a group area before social behavior could occur. That dyadic episodes occurred at all when free access to the large group areas was available shows the motivational effects of even such minimal social contact.

The triadic conditions were associated with longer periods of social contact than those observed under dyadic conditions. Under triadic conditions,

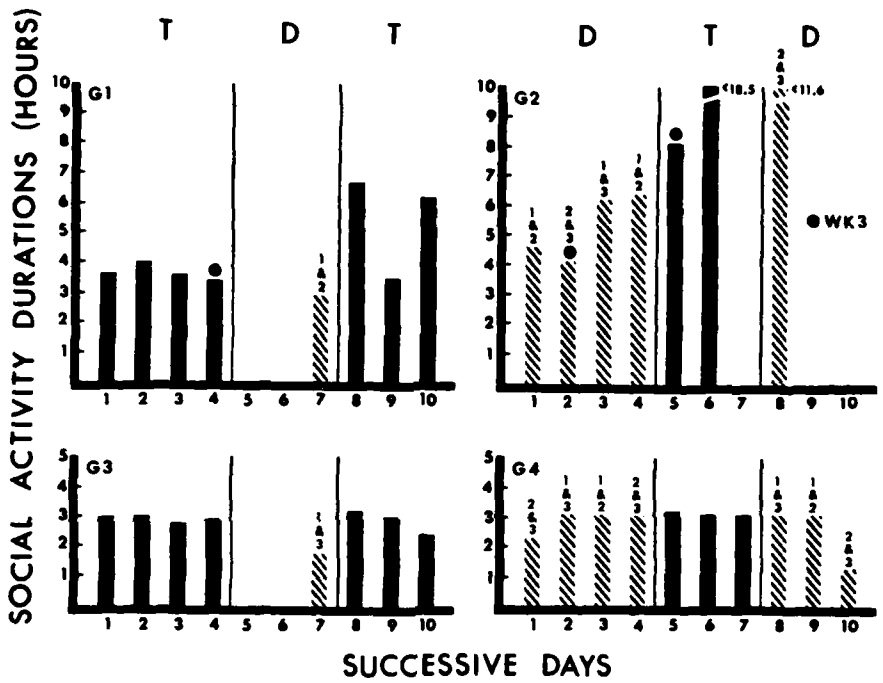


Figure 10. Social activity durations across successive days of the experiment for all groups. Bars represent durations of individual episodes. Numbers above dyadic durations identify the two subjects engaged in the episode. T = triadic condition; D = dyadic condition.

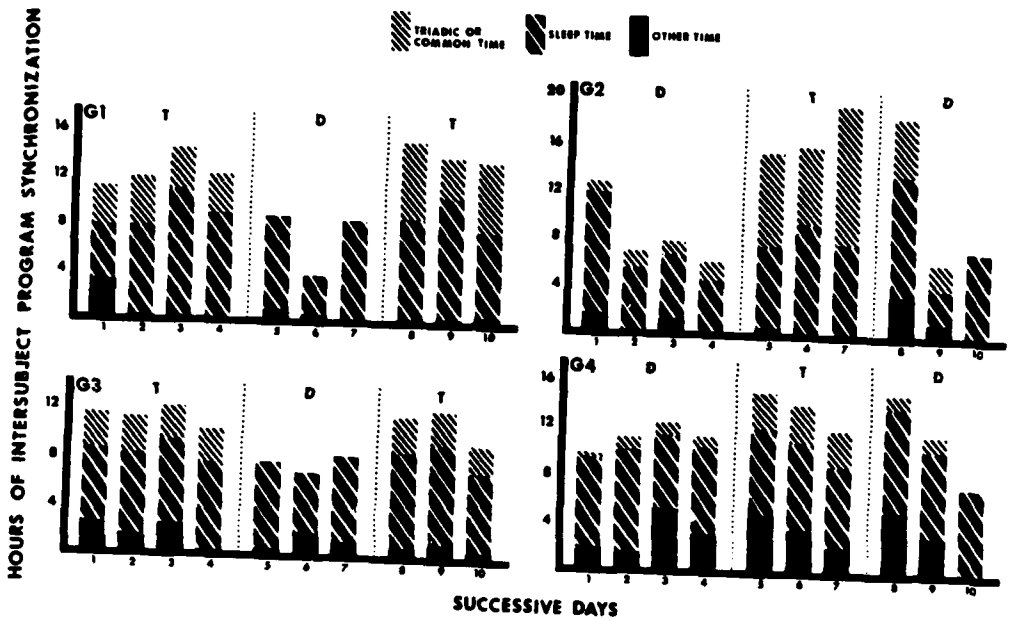


Figure 11. Total hours of intersubject program synchronization for each group across successive days of the experiment.
T = triadic condition; D = dyadic condition.

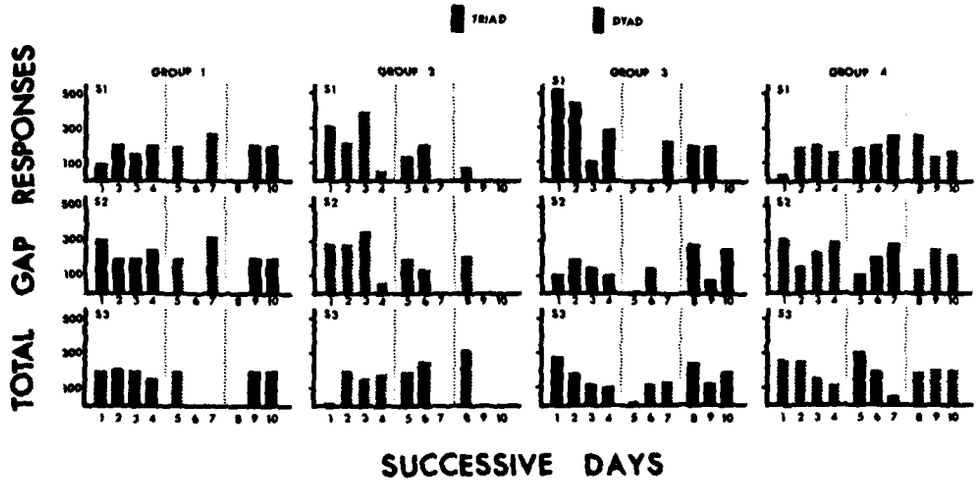


Figure 12. Total group-task (GAP) responses for all subjects in each group across successive days of the experiment.

lone members were immediately integrated into social activities that continued to occur on each successive day of the triadic condition. In addition, the triadic condition was always associated with more schedule synchrony than that observed under dyadic conditions. These latter effects are similar to those observed in the previous study in which the cooperation condition produced a greater magnitude of synchrony than the non-cooperation condition. Enhanced synchrony observed under both cooperation and triadic conditions in the two studies substantiates the motivational effects of triadic social opportunities upon the reduction of intersubject discrepancies in the selection and completion of behavioral program activities.

Of particular interest were the results obtained when the mean social distance scores for all subjects observed over triadic episodes were rank ordered from high to low and plotted against corresponding percents of time in dyadic social episodes during dyadic conditions, as illustrated in Figure 13. A coefficient of correlation between these social distance scores and percents of time in dyadic episodes during dyadic conditions revealed a significant inverse relationship ($r = .79$, $p<.01$). These data show that as the physical distance between subjects increased for a given subject within a triadic group setting, the proportion of time he spent in social episodes decreased during dyadic conditions, predicting with reasonable accuracy the sociability of group members under conditions requiring group fragmentation.

3. Motivational Studies

The robust effects of social contingencies upon the behavior of small groups within the continuously programmed environment provided the basis for extensions of such group interaction analyses to investigate the role of explicitly programmed motivational operations. Three 10-to-12-day, three-person experiments incorporated a "work unit" completion contingency determining the

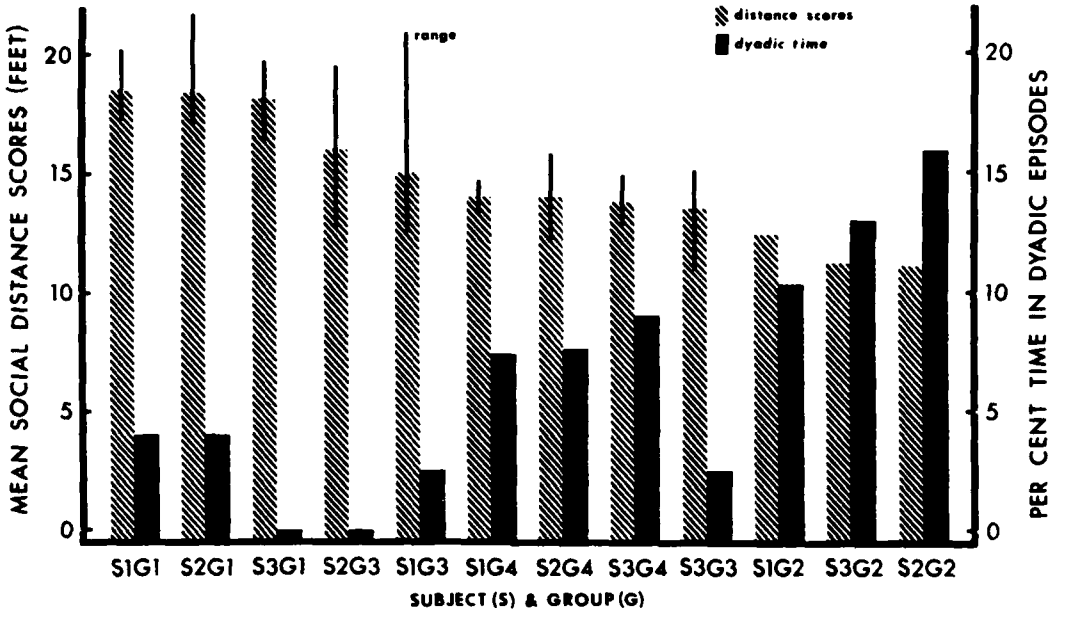
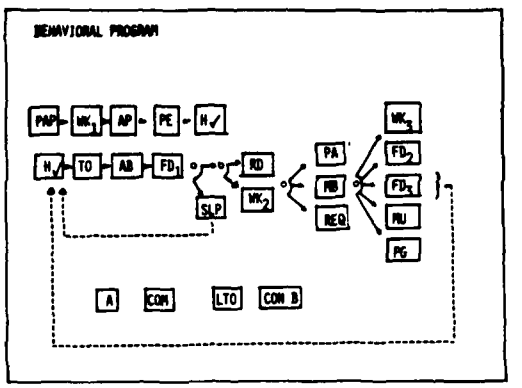


Figure 13. All subjects' mean social distance scores, rank ordered from high to low, plotted against corresponding percents of time in dyadic social episodes during dyadic conditions. The ranges of social distance scores between episodes are given for all groups except Group 2, which had only one triadic episode in the recreation room.

amount of group remuneration for participation in the study. In all previous experiments, individual subjects received a fixed per diem allowance (i.e., $25) for participation regardless of their performance. In contrast, the present series of motivational studies provided a programmatically controlled amount of remuneration for each completed work unit by an individual subject in the form of a contribution to a group "bank account," with group earnings divided evenly among the participants upon completion of the experiment.

The basic fixed and optional components of the behavioral program continued to be in effect during these experiments with a sequence of work unit activities made available independently of the remaining sequentially arranged activities, as illustrated in Figure 14. The five work unit activities included: (1) Private Arithmetic Problems (PAP), requiring 200 correct solutions; (2) Work One (WK1), requiring 5000 lever operations; (3) Arithmetic Problems (AP), requiring 50 correct solutions; (4) Physical Exercise (PE), requiring 400 correct presses; and (5) Health Check (H√), requiring completion of the health assessment battery. This work unit could be selected upon completion of any activity within the full behavioral program. Once a work unit had been selected, all five activities had to be completed before the subject could resume the behavioral program at the location where the work unit was voluntarily initiated. During a work unit, the Communication activity was unavailable, and subjects were not permitted to use the tape player for music. The parameters for the several component activities were chosen such that one to two hours were required for completion of a work unit.

The consequences of completing a work unit were systematically varied to assess the effects of alternative behavior-consequence relationships under program control. Throughout the initial four days of the first experiment, for example, a "positive" (i.e., appetitive) relationship was in effect whereby



INVENTORY OF ACTIVITIES

Abbreviation	Full Name	Brief Description
PAP	Private Arithmetic Problems	200 correct solutions to arithmetic problems
WK_1	Work One	5000 lever operations
AP	Arithmetic Problem	50 correct solutions of arithmetic problems
PE	Physical Exercise	400 correct presses on automated task
H✓	Health Check	Temperature, pulse, weight, status report
TO	Toilet Operations	Use of bathroom and contents of TO drawer, toiletries, clean clothing
AB	Autogenic Behavior	Relaxation exercises on cassette tape
FD_1	Food One	Two selections from a list of light foods
SLP	Sleep	Use of bed and privacy curtain
RD	Reading	Access to book
WK_2	Work Two	Problems, experiments, assembly tasks
PA	Puzzle Assembly	Assemble a puzzle
MB	Manual Behavior	Access to art materials
REQ	Requisition	Press a lever to earn treats
WK_3	Work Three	Social option, access to communal workshop
FD_2	Food Two	Private major meal
FD_3	Food Three	Social option, access to recreation room, meal, games
MU	Music	8000 lever presses to earn a cassette tape
PG	Private Games	Access to games drawer
A	Audit	Free access to group "bank account" records
COM	Communication	Access to intercom
LTO	Limited Toilet Operations	Access to essential toilet facilities
COM B	Condition B	Used to signal change in program rules

Figure 14. Diagrammatic representation of modified behavioral program showing sequences of independently available work unit activities arrayed upper left above the sequentially programmed behavioral activities.

completion of a work unit by an individual subject produced a $10 deposit to the group bank account. Throughout the next four days of the experiment, a "negative" (i.e., avoidance) relationship was in effect such that work units no longer produced $10 increments in the group bank account, but rather were required of the participants in order to avoid withdrawals of similar magnitude. That is, work performance requirements for days 5 through 8 provided that a $10 withdrawal be made from the group bank account for each uncompleted work sequence below an assigned daily total (e.g., 20) determined on the basis of the group productivity sequences completed per 24 hours. This group requirement could be satisfied under any conditions of individual work scheduling or distribution decided upon by the group participants. The last two days of the experiment, days 9 and 10, were programmed as a return to the conditions in effect during the first four days. Such incentive conditions were chosen for investigation because of the evidence linking (1) hostility and aggression with aversive control (e.g., Hutchinson, 1976) and (2) dissipation of hostility to cooperative goals pursued under appetitive circumstances (e.g., Sherif, 1967; Deutsch 1963).

The work unit contingency maintained substantial productivity levels for all subjects throughout the course of the experiment. No participant completed fewer than five work sequences per day with a range of 5 to 14 units. A distinguishable and relatively stable pattern of group work performances and social interactions emerged during the first four "appetitive" days of the experiment. Although all members of the group were not contributing equally to the group bank account (i.e., one of the three participants consistently completed fewer work units than the other two during this period), a high degree of group cohesiveness was reflected in the social episodes, the intercom exchanges, and the frequent use of the "audit" option available to each

participant for monitoring the status of the group bank account and the individual contributions thereto.

In contrast, the second four-day segment of the experiment (i.e., days 5 through 8) with work performances aversively maintained by avoidance of group monetary resources diminution was characterized by a dramatic change in the relatively stable work-rest pattern observed during the first four days, and by a progressive deterioration of group cohesiveness. Beginning with day 5, work schedules were drastically altered by the group, and the two productive members of the group became openly intolerant of the third participant's "below-par" performance. As a result, this low-productivity participant was progressively isolated from the group and spent days 7 and 8 alone in his private chamber. Concomitantly, all three members of the group became openly hostile and vehemently expressive of their displeasure with the program control perceived as responsible for this obviously "aversive" state of affairs, as reflected in ratings for days 5 through 8 shown in Figure 15.

Paradoxically, group productivity as grossly estimated from work unit completions was not materially affected by the change from appetitive to aversive maintaining conditions, and the absolute number of work units completed by the low-productivity group member (S2) actually increased slightly during days 5 through 8 as shown in Figure 16. Both the daily work-unit frequency and the total number of hours devoted to work by the group participants were maintained at relatively stable levels throughout the two four-day intervals, and remained sufficiently high during the avoidance contingency in effect from days 5 through 8 to prevent even a single withdrawal from the group bank account. And on the basis of a more detailed analysis of the several component tasks in the work units as summarized in Figure 17, there is little evidence that performance effectiveness was differentially influenced by the two

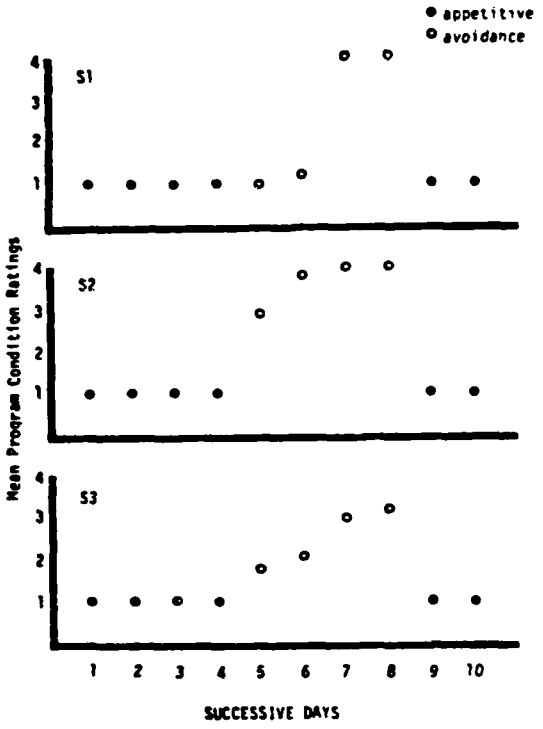


Figure 15. Mean ratings of the experimenters on a 4-point scale progressing from 1 ("not at all irritated at the experimenters") to 4 ("extremely irritated"), across successive days of the experiment. Ratings were obtained during each Health Check activity.

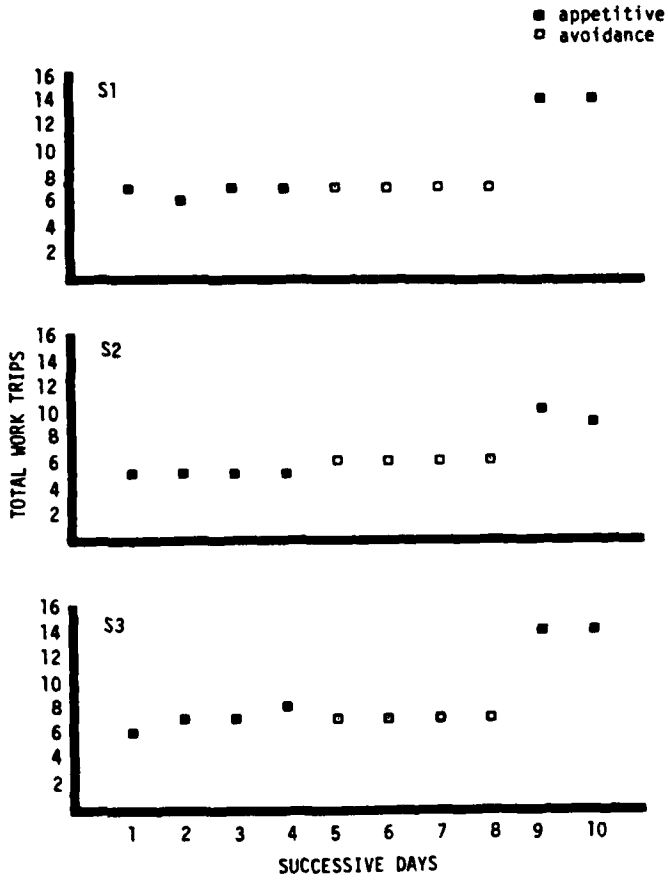


Figure 16. Total work units completed by all subjects across successive days of the experiment.

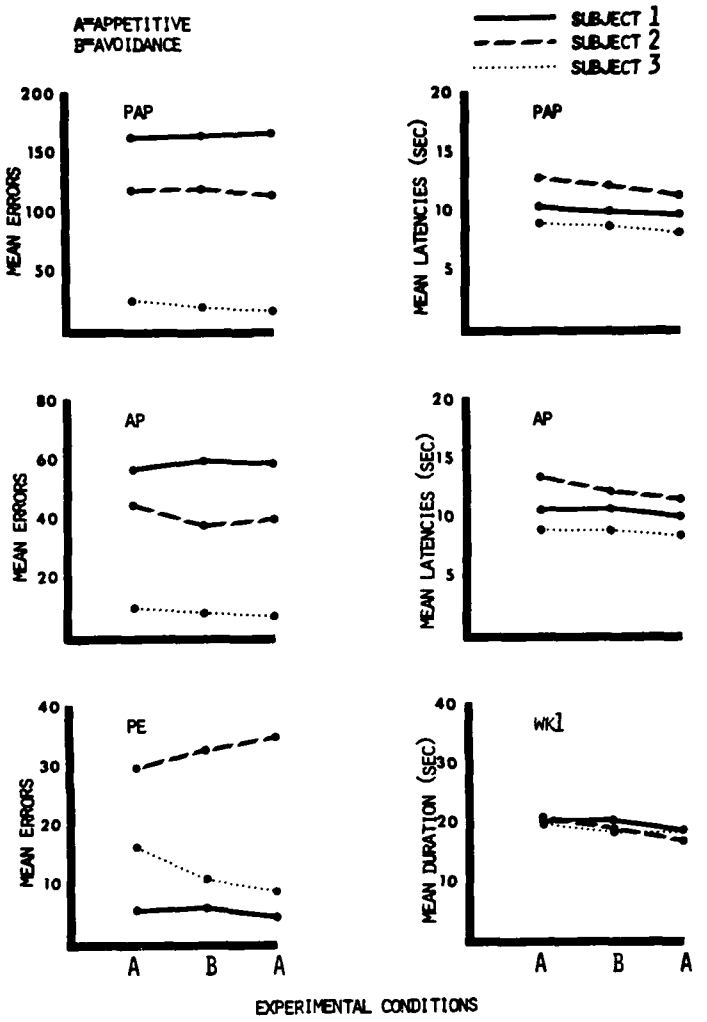


Figure 17. Mean performance effectiveness on the several components of the work unit across successive experimental conditions.

conditions. This finding is in marked contrast to the dramatic changes in group cohesiveness, ratings of program control conditions, and both interpersonal (e.g., "irritation") and intrapersonal (e.g., "mood") ratings recorded by the subjects during days 5 through 8.

Although these socially disruptive by-products of the aversive control procedures in effect during the avoidance segment of the experiment did not produce obvious decrements in either individual or group effectiveness on work unit performance, changes did occur in the distribution of work units as a function of the transition from appetitive to aversive motivational conditions. These effects are presented graphically in Figure 18, which shows the distribution of work unit time (shaded segments) over successive days (depicted as 24-hour clocks) under each of the three program conditions. During days 1 through 4, the completion of one or two work units was typically followed by a rest break during which a social episode (e.g., communal meal) would usually occur. Additional brief work periods would then generally occur interspersed with individual or social recreational interludes before sleep. In contrast, days 5 through 8 were characterized by a dramatic change in this work-rest pattern with comparable numbers of work units compressed into more restricted time segments as shown on the 24-hour clocks for this avoidance period. This alteration in the temporal distribution pattern effectively insured that the daily group performance requirement (i.e., 20 work units) was completed before any social or recreational episodes occurred. Significantly, the progressive deterioration of group cohesiveness, shown in Figure 19 by the progressive decrease in triadic social interaction over days 5 through 8, developed concurrently with this change in the work-rest pattern.

The extremely high work rates reflected in the 24-hour clock distribution for days 9 and 10 following reversal to the appetitive motivational conditions

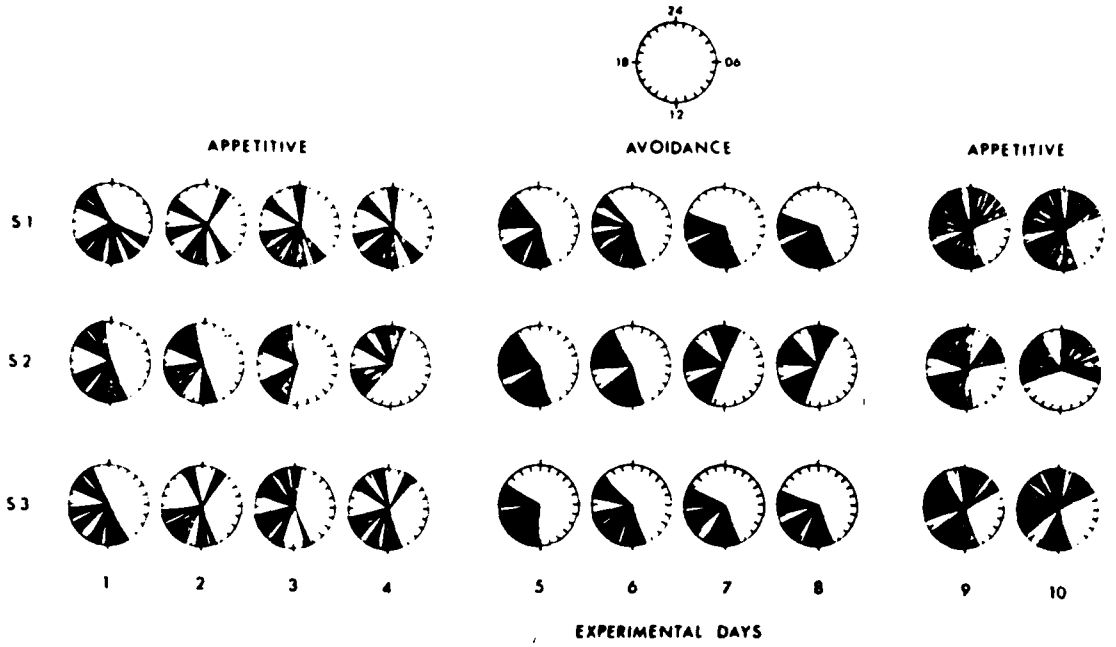


Figure 18. The distribution of work unit time (shaded segments) over successive days (depicted as 24-hour clocks) under each of the three program conditions.

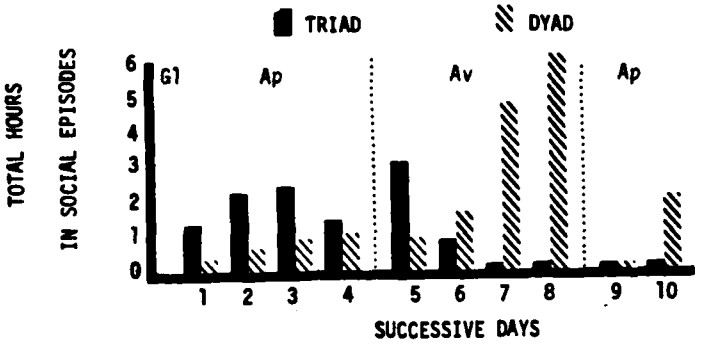


Figure 19. Total dyadic and triadic time in minutes over successive days of the experiment.

of days 1 through 4 probably accounts at least in part for the group fragmentation which persisted throughout these final two days of the experiment. While this final burst of work activity can be attributed to some combination of "emotional" facilitation occasioned by the condition change (i.e., from aversive to appetitive control) on the one hand, and the "motivational" potentiation produced by temporal proximity of the behavior-maintaining consequence (i.e., the "pay-off" at the end of the experiment), it is noteworthy that this extremely high work output (far exceeding those levels observed during any of the 25 previous experiments conducted in our laboratory) occurred in the absence of any deleterious side effects to the subjects. In fact, the rating data shown in Figure 15 along with the "Mood Scale" assessments obtained during each Health Check activity reflected virtually complete recovery to the positive levels which characterized the first four days of the experiment.

To provide a more detailed analysis of such motivational and emotional interactions under aversive and appetitive programming conditions, as well as to control for order effects attributable to the temporal sequence in which these diverse programming conditions were presented, two additional 12-day experiments were conducted, one with three male participants and one with three females. The experimental methodology and general programming procedures were basically similar to those illustrated in Figure 14, with this exception: an expanded group of work unit activities (e.g., perceptual, memory, vigilance, etc.) was programmed for the second group of male subjects, and the order and number of days of exposure to the appetitive and aversive conditions were varied. Both groups resided in the continuously programmed environment for 12 days with the appetitive (Ap) and avoidance (Av) conditions in effect in the following order and number of successive days under each condition, respectively: Ap-Av-Ap-Av (3, 3, 3, 3), and Ap-Av-Ap (3, 6, 3).

As with the first group, the work unit contingency, requiring approximately one hour for completion, maintained substantial productivity levels for all subjects in each of these two additional groups. Figure 20, for example, summarizes the total number of work units completed by all subjects across successive days of the three group studies. No subject completed fewer than two work units per day (e.g., Subject 2 in Group 2 on Day 1) with a range of 2 to 16 units. Within all groups, the work unit outputs were more evenly distributed among subjects during the avoidance condition than during the appetitive condition. A comparison between the two conditions of the differences between the highest and lowest work frequency for all subjects in each group (under the assumption that such differences approach zero when variability is absent) showed a significant effect.

Subjects with a relatively low daily work unit output during the first appetitive condition showed a work unit performance increment during the succeeding avoidance condition (e.g., S2G1, S2G2, S3G2, and S2G3). And Group 3, like Group 1, showed a dramatic increase in daily work unit frequency when the appetitive condition was reintroduced for the final three days of the study. The less than dramatic change in this regard observed with Group 2 can probably be attributed to some combination of the more demanding requirements of the work unit activities programmed for this group (i.e., the motivational effects of increased "response cost") and the order effects produced by multiple condition reversals and termination of the study with the avoidance contingency in effect (i.e., the emotional effects of aversive occasioning circumstances).

With respect to the intrapersonal aspects of the program condition effects, almost all subjects reported mood changes between program conditions on the Depression factor of the Lorr's Outpatient Mood Scale which was administered during each Health Check activity. Eight of the nine subjects showed the

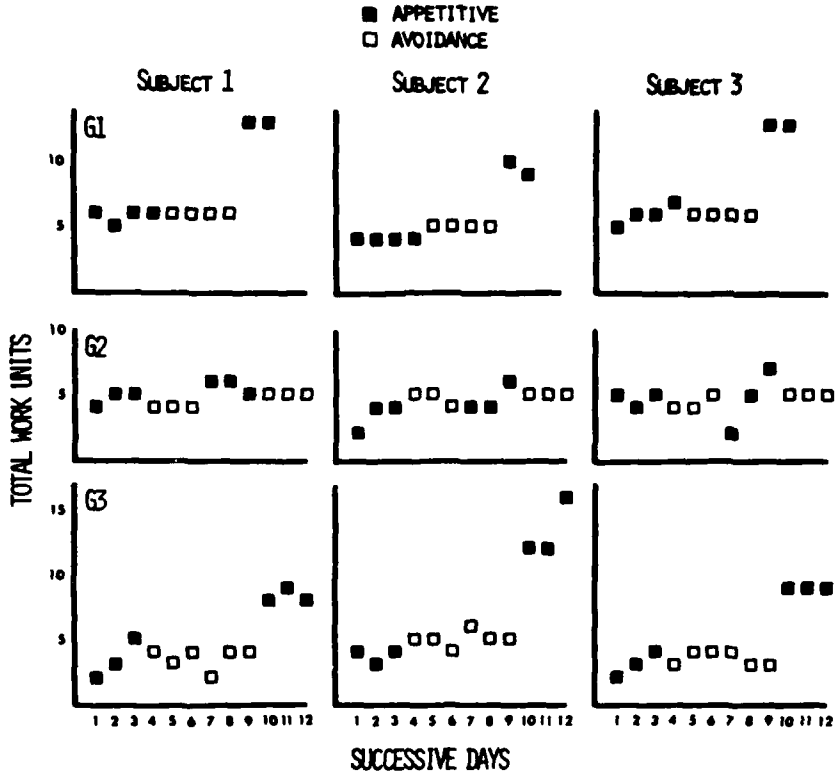


Figure 20. Total number of work units completed by all subjects across successive days of the three experiments.

highest ratings during the avoidance condition, and, for a pooled analysis, the avoidance condition was associated with significantly higher depression ratings. Additionally, Figure 21 shows that on a 4-point scale reflecting degree of irritation (1=none to 4=extreme) with the program condition, all subjects in each group displayed more irritation during the avoidance condition than during corresponding appetitive program conditions.

As with Group 1, the three male subjects in Group 2 showed local effects of the avoidance condition in the form of clear displays of aggression. Members within Group 2 evidenced destructive behaviors in relationship to laboratory property (e.g., kicking the walls and damaging the furniture) and repeatedly failed to conform to the requirements of the behavioral program. In contrast, the three female subjects in Group 3 displayed no such aggressive or hostile behaviors, even after six successive days under the avoidance contingency, though their program rating scores (Figure 21) did show a modest degree of intermittent irritation in the course of this extended exposure to the aversive avoidance condition.

The fourth experiment completed within this series (Emurian, Emurian & Brady, in press) was even more revealing in that some group members undertook a sitdown strike with respect to work, after reacting for several days in ways which appear parallel to crew reactions preceding the strike that occurred aboard the third Skylab mission. This systematic replication of the previous experiments involved the introduction of a multiple task performance battery determining work performance within a duty station which could be occupied by subjects one at a time on a self-determined rotational basis. Accordingly, it simulated situations requiring a group to be continuously vigilant with respect to critical mission demands. Thus, the coordination required of group participants to accomplish mission objectives (i.e., maximum performance

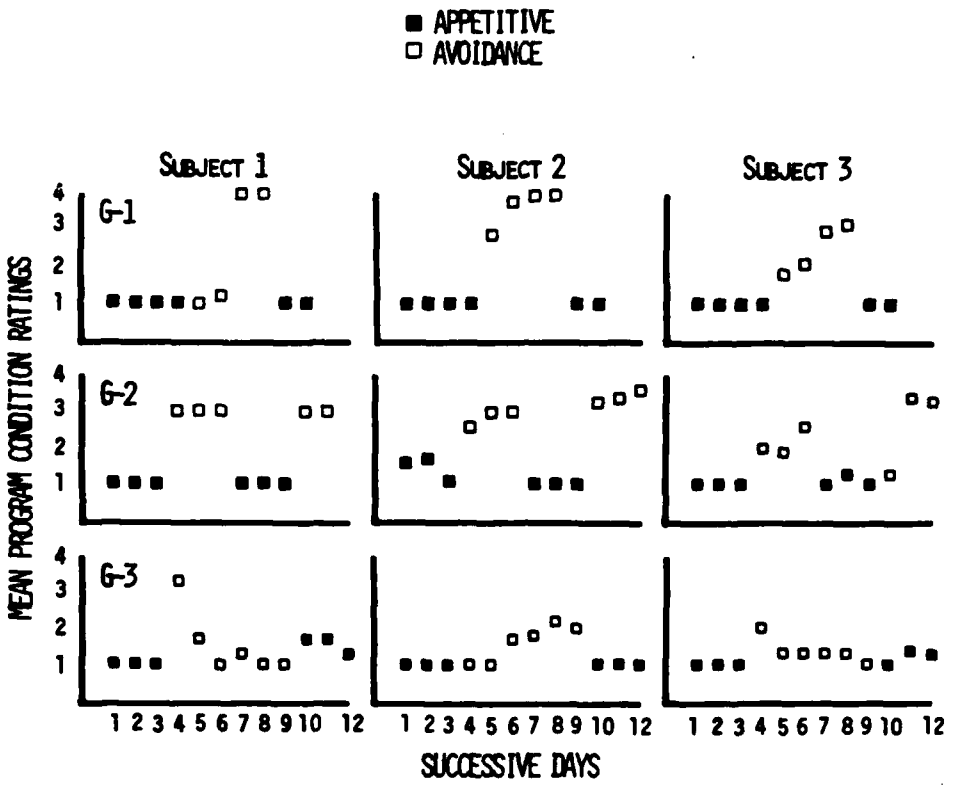


Figure 21. Mean daily ratings of the program condition on a 4 point scale reflecting degree of irritation (1=none to 4=extreme) for all subjects in each group.

productivity) was operationalized in terms of the synchrony required for sequential performance episodes across successive 24-hour observational intervals (Thorndyke and Weiner, 1980, p. 4). These procedural innovations were intended (1) to extend the analysis of reinforcement effects to a somewhat different set of experimental conditions and thus (2) to demonstrate the reliability and generality of previous results.

A Multiple Task Performance Battery (MTPB) was used as the major performance assessment tool throughout the experiment. Figure 22 presents a photograph of the console on which the performance tasks were presented on a cathode ray tube display terminal. The battery was composed of the following five task components which were presented concurrently to an operator: (1) blinking lights, providing a measure of watchkeeping, (2) warning lights, providing a measure of vigilance, (3) probability monitoring, providing a measure of attentive functions, (4) target identification, providing a measure of sensory-perceptual functions, and (5) arithmetic operations, providing a measure of computational functions. Accurate responses produced points (1 point=1 cent) which were presented on the screen as they were accumulated. The parameters associated with the tasks were chosen so that an operator with 5-10 hours of practice could accumulate 500-600 points per hour, and the upper limit of performance was approximately 750 points per hour. A comprehensive description of the performance battery has been published by Emurian (1978), and a rationale for this "synthetic work" methodology has been provided by Morgan and Alluisi (1972).

Subjects followed the behavioral program continuously throughout the 6-day experiment. Additionally, the rules by which remuneration for participation was accumulated or maintained were varied to assess the effects of appetitive and aversive motivational conditions on behavior.

Figure 22. A photograph of the console on which the performance tasks were presented on a cathode ray tube display terminal.

Under an appetitive motivational condition, any group member's accurate responding on the MTPB produced points resulting in corresponding monetary deposits in a group account that was to be divided evenly among members at the conclusion of the experiment. Under an aversive motivational condition, the group was assigned a point criterion to be completed during the next twenty-four hours. This criterion was based upon the daily performance productivity of the group observed during the immediately preceding appetitive condition. No money was deposited in the group account during the aversive condition, and if the criterion were not reached on a given aversive day, the group account was reduced by the number of points falling below the criterion.

The appetitive (AP) and aversive (AV) conditions were in effect in the following order and number of days, respectively: (AP, AV, AP: 2, 3, 1). Subjects were informed at the beginning of each day about which condition would be in effect for the next 24 hours.

Between- and within-subjects' differences were observed in points earned per day on the Multiple Task Performance Battery. These data are shown in Table 6 which presents total points earned by each group member across successive days of the experiment along with the criterion assigned to the group during aversive days. Variability in productivity among mission members is evident on Day 1 when Subject 3 contributed only 19.8% of the total points earned on that day, in comparison to 41.2% and 40.0% for Subjects 1 and 2, respectively.

Subjects initially adopted an orderly and alternating sequence of occupying the duty station to operate the MTPB, with each work episode lasting approximately 4 hours. These data are presented in Figure 23 which presents time of day spent working for all subjects across successive days of the experiment. During the first three days of the study, there was almost perfect day-to-day agreement with respect to the time of day when each subject worked.

TABLE 6

TOTAL MTPB POINTS PER DAY

Successive Days

	Appetitive Days No Criterion		Aversive Days Criterion=12700			Appetitive Day No Criterion
Subject	1	2	3	4	5	6
1	4554	4221	4388	4627	0	5648
2	3927	4381	4437	4810	2450	5023
3	2000	4126	3966	3207	3755	4487

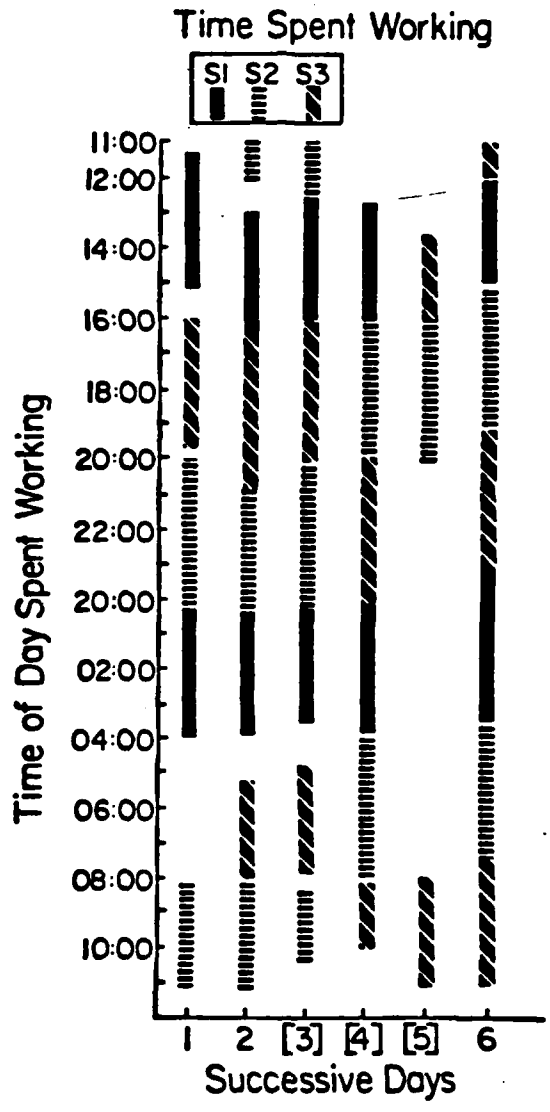


Figure 23. Time of day spent working for all subjects across successive days of the experiment. Days which are bracketed (i.e., 3, 4 and 5) are aversive days; other days are appetitive days.

On day 4, the second aversive day, however, Subjects 2 and 3 switched positions from the previously established pattern, with Subject 3 now working later in the day in comparison to his work times during the preceding appetitive days. On Day 5, Subject 1 failed to work, and Subject 2 worked on only one occasion. On Day 6, the final appetitive day of the experiment, the disruptive effects observed on Day 5 were reversed, and subjects adopted an alternating work sequence identical to that observed on Day 4. Finally, only Subject 1 maintained a consistent time of day when he worked (with the exception of Day 5) across successive days of the experiment.

The comparatively few work episodes which occurred on Day 5 of the experiment, as shown in Figure 23, were related to the following incident which occurred on the previous day. On Day 4, the second day of the aversive condition, a crisis occurred within the crew which not only resulted in withdrawal from work by a participant but also compromised the crew's ability to complete the "mission" (i.e., satisfaction of the assigned daily work criterion). On that second day of the aversive condition, Subject 3 fell behind in his share of work, as agreed upon by group participants, and he caused the criterion to be missed by 56 points. Unlike a high-productivity participant's tolerance of variation in work output during the appetitive condition (e.g., Day 1), this group member (Subject 1) became openly hostile at this relatively trivial shortcoming, and he reprimanded Subject 3 during an intercom conversation at the end of Day 4. Significantly, Subject 1 refused to perform any further work during the aversive condition, whose duration was not known by the group, and on Day 5 the group lost heavily in potential earnings as a result, as least in part, of insufficient personnel to operate the performance battery on an efficient basis. Of at least equal importance was the fact that Subject 1's emotional outburst and his refusal to work was, in part, paralleled

by Subject 2 who showed a markedly diminished output of work on Day 5. Neither Subject 2 nor Subject 3 showed a compensatory increase in work productivity on Day 5 that may have otherwise satisfied the criterion which was missed on that day by 6495 points.

When the appetitive condition was reintroduced on Day 6, Subjects 1 and 2 again contributed to work output, and, indeed, all subjects showed the greatest daily point accumulations on that final day of the experiment.

Wake-sleep cycles did not fall into stable and orderly patterns across the course of the experiment. These data are shown in Figure 24 which presents time of day spent sleeping for all subjects across successive days of the experiment. Sleep episodes typically were less than 8 hours in duration, and more than one sleep period per day occurred for most subjects. Subject 1, however, adopted brief but regular sleep periods for the first four days of the experiment, in comparison to such sleep periods exhibited by Subjects 2 and 3. Subject 1 abandoned his previously established patterns on Day 5, the day when he refused to work, and he did not return to his earlier sleep cycles on the subsequent final day of the experiment. These effects are attributable, at least in part, to the style of alternating work that the subjects initially adopted to occupy the duty station around the clock. Perhaps more importantly, these data suggest that the structured approach to both work times and sleep cycles demonstrated during the first four days of the experiment by Subject 1 could not be similarly sustained by remaining participants across the course of the experiment.

The disruption in team cohesion during the aversive condition was also reflected in the way the team members reported feeling about one another. During each Health Check activity in the behavioral program, each team member completed a 4-point scale reflecting degree of irritation (1=none to 4=extreme) with the other two members. Table 7 presents mean ratings of such irritation

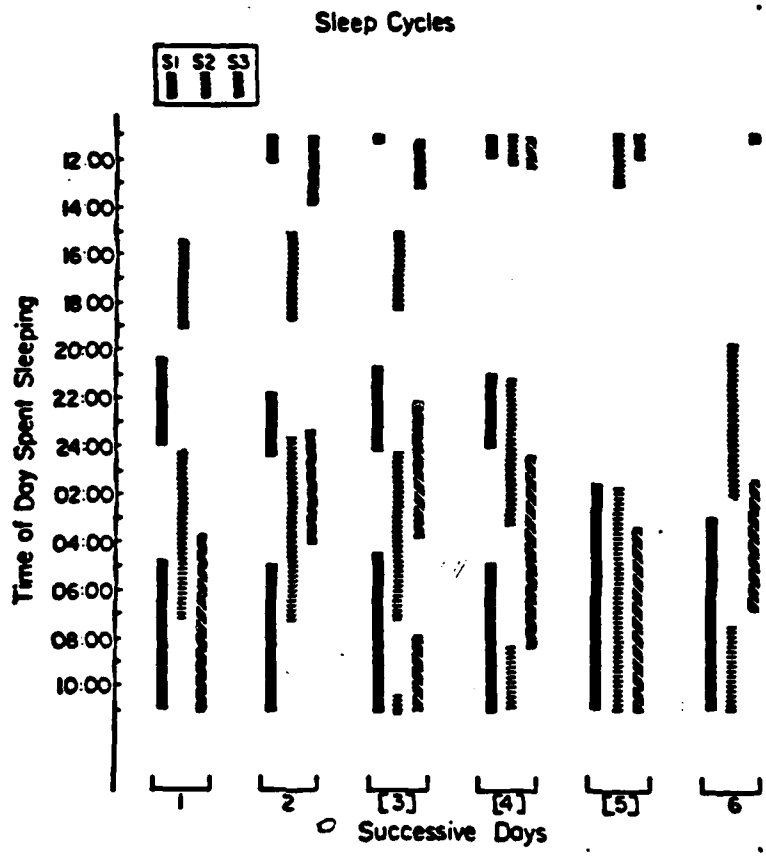


Figure 24. Time of day spent sleeping for all subjects across successive days of the experiment. Days which are bracketed (i.e., 3, 4 and 5) are aversive days; other days are appetitive days.

for all subject-paired combinations across days. For all subjects, the greatest irritation with another member occurred during the aversive condition (Subject 1 toward Subject 3 on Days 3 and 5, Subject 2 toward Subject 3 on Day 3, and Subject 3 toward Subject 1 on Day 5).

The expressed opinions and emotional attitudes of the team directed to the behavioral program and to the experimenters differed between conditions as assessed from similar 4-point scales. Figures 25 and 26 present mean ratings on these scales for all subjects across days. With respect to the behavioral program, all team members expressed increasing irritation with the program over successive aversive days in contrast to no expressed irritation during the preceding and succeeding appetitive days. With respect to the experimenters, Subject 1 (the team member who did not work on Day 5) reported most irritation during the aversive condition.

With respect to the intrapersonal effects of the incentive conditions, all subjects reported dysphoric mood during the avoidance days in comparison to the preceding appetitive days. These data are presented in Table 8 which shows mean ratings on the Depression factor of the Lorr's Mood Scale (Lorr, Daston and Smith, 1967), which was administered during each Health Check activity, for all subjects across successive days of the experiment. Subjects 1 and 2 showed the highest Depression rating on Day 5 of the experiment which was the final day of the avoidance condition. Importantly, these elevated ratings were associated with cessation of work by Subject 1 and diminished work by Subject 2. Additionally, both Subjects 1 and 2 showed a comparative reduction in Depression ratings on the next and final appetitive day (i.e., Day 6) of the experiment despite the increases in MTPB productivity which were observed. Subject 3, the group participant whose daily performance productivity was consistently somewhat less than the other group members, showed the highest Depression rating on Day

TABLE 7

MEAN INTERPERSONAL RATINGS PER DAY

		Successive Days					
		Appetitive Days		Aversive Days			Appetitive Day
Subject Rating	Subject Rated	1	2	3	4	5	6
1	2	1.3	1.5	1.0	1.0	1.0	1.0
	3	1.3	2.0	2.3	2.0	2.6	2.0
2	1	1.0	1.0	1.0	1.0	1.0	1.0
	3	1.0	1.0	2.3	1.0	1.0	1.0
3	1	1.0	1.0	1.0	1.0	2.3	1.5
	2	1.3	1.5	1.0	1.0	1.0	1.0

TABLE 8

MEAN DEPRESSION RATINGS PER DAY

	Successive Days					
	Appetitive Days		Aversive Days			Appetitive Day
Subject	1	2	3	4	5	6
1	8.7	9.0	8.7	8.0	12.6	8.5
2	9.5	10.3	13.0	13.3	14.0	10.3
3	8.3	8.3	9.0	8.8	9.7	10.0

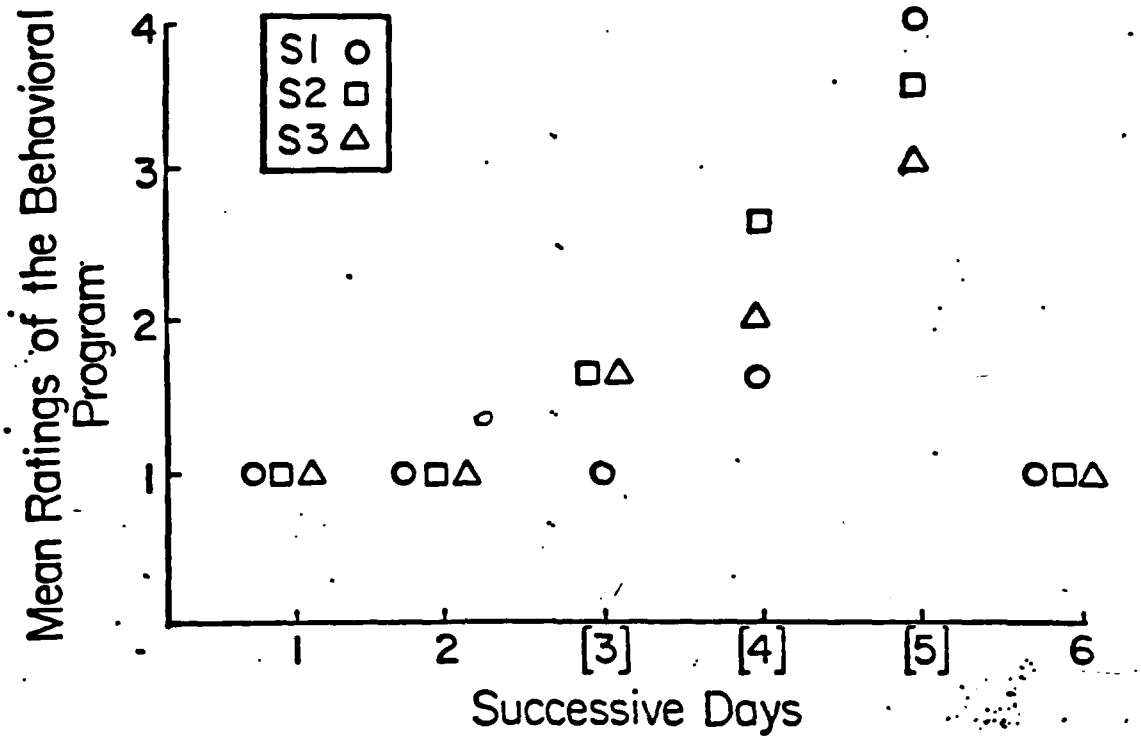


Figure 25. Mean ratings of the behavioral program, on a 4-point scale where 1 = not at all bothered by the program and 4 = extremely bothered, for all subjects across successive days of the experiment. Ratings were obtained during health and status assessments which occurred several times each day. Days which are bracketed (i.e., 3, 4 and 5) are aversive days; other days are appetitive days.

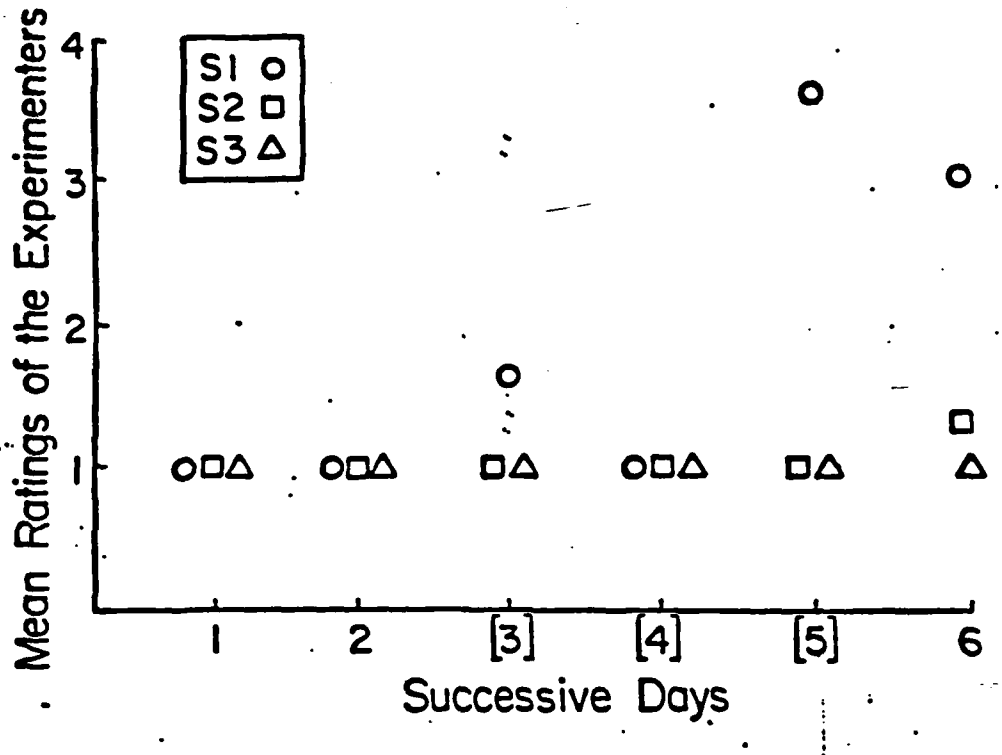


Figure 26. Mean ratings of the experimenters, on a 4-point scale where 1 = not at all bothered by the experimenters and 4 = extremely bothered, for all subjects across successive days of the experiment. Ratings were obtained during health and status assessments which occurred several times each day. Days which are bracketed (i.e., 3, 4 and 5) are aversive days; other days are appetitive days.

6, the final appetitive day of the experiment when he demonstrated his greatest MTPB point potential. These data, then, suggest that performance productivity itself need not be a major source of dysphoric mood (i.e., "low morale") by such team participants since two of the three group members were most dysphoric during days when their work productivity was minimal. The consequence of such reduced work, however, was the introduction of an aversive event (i.e., monetary loss) which was occasioned, at least in part, by the presence of a group participant (i.e., Subject 3) who was unable or unwilling to adopt the performance norms of the majority of the group members.

Only two social episodes occurred during the course of the 6-day experiment. Subjects 2 and 3 engaged in a 108-minute social episode on Day 4, the second day of the aversive condition, and Subjects 1 and 2 engaged in a 244-minute social episode on Day 5, the third and final day of the aversive condition. This latter episode occurred on the day when Subject 1 refrained from working and Subject 2 reduced his customary productivity. The fact that no triadic social episode occurred perhaps indicates the failure or inability of this group to develop, without external influences, an early cohesiveness which may have otherwise preverted the performance decrements and interpersonal confrontations which emerged during the avoidance days of the experiment.

The behavioral effects observed in this last experiment were related to hormonal levels obtained from analyses of total urine volumes collected throughout the course of the experiment. Figure 27, for example, shows a strong overall relationship for these three subjects between individual MTPB productivity and mean daily cortisol levels determined by radioimmunoassay (Mougey, 1978). A direct relationship is evident between mean MTPB points per day and mean cortisol per day with the crew member showing the highest average MTPB productivity (Subject 1, omitting Day 5) also showing the highest average

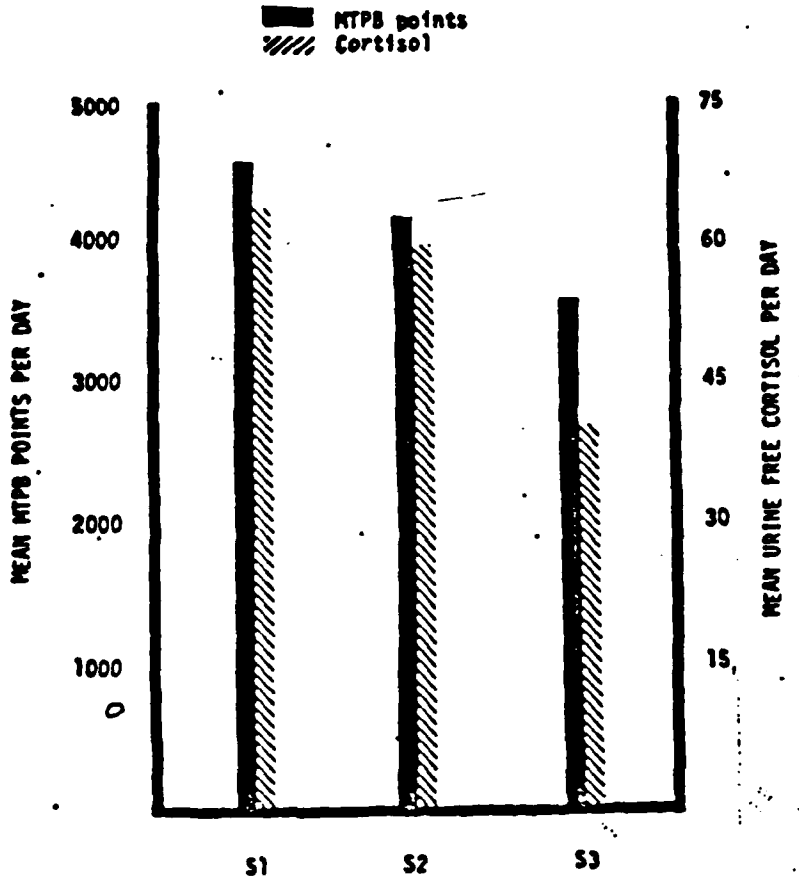


Figure 27. The relationship for the three subjects between individual MTPB productivity and mean daily cortisol levels determined by radioimmunoassay.

cortisol level. Conversely, the crew member showing the lowest average MTPB productivity (Subject 3) also showed the lowest average cortisol level. Significantly, Subject 1 was the high-productivity participant who refused to work on Day 5 of the mission, and Subject 3 was the low productivity participant who failed to reach the criterion on Day 4 of the mission. These observations together suggest that sustained high productivity along with prolonged performance accuracy on a demanding task may render an individual vulnerable to disruptive emotional reactions such as those provoked by the avoidance phase of the study. Most importantly perhaps, these results emphasize the contributions of a multi-dimensional analysis of individual and group performance effectiveness, and they clearly demonstrate the utility of programmed environment methods and procedures in assessing the broad range of dependent measures which encompass such an analysis.

4. Group Composition Studies

These foregoing investigations clearly established social variables as fundamental contributors to the overall status of a confined microsociety, and they emphasized the sensitivity of such variables to a range of experimental manipulations having operational significance. Throughout such studies, mission participants were observed to seek social interaction under one set of conditions (e.g., cooperation contingencies and appetitive performance outcomes) and to withdraw from such interaction under other conditions (e.g., pairing contingencies and avoidance performance outcomes). Thus, the joining and leaving of a group by mission participants under circumstances encompassing more than a single environmental condition would appear to generate social effects reflecting important dynamic processes requiring systematic experimental analysis.

Accordingly, group performance effectiveness studies were initiated to

assess the effects on individual and group behavior of a novitiate participant's introduction into and withdrawal from a previously established and stable two-person social system. The objective of the first two such studies was to focus upon (1) the social mechanisms and temporal properties associated with the integration of such a participant into an established group, and upon (2) sources of group disruption and/or cohesiveness fostered by his presence. In addition, measures of hormonal levels based upon the collection of total urine volumes throughout the course of the studies focused upon changes in the androgen testosterone as an endocrinological index of demonstrated sensitivity to social interaction effects in both animals (Eberhart, et al., 1980; Bernstein, et al., 1979) and humans (Scaramella and Brown, 1978). Such a behavioral-biological analysis was implemented to provide a more valid and reliable assessment of the individual and social impact generated by introduction and withdrawal of new members with an established group (Frankenhauser, 1979).

Urinary testosterone levels were determined by radioimmunoassay. Following a 72-hr hydrolysis with beta glucuronidase, the samples were extracted with methylene chloride. The methylene chloride layer was washed with water and dilute sodium chloride and then evaporated. The extracts were purified on LH-20 Sephadex columns. Recoveries through the procedure were monitored by the addition of a small amount of tritiated testosterone added to each sample prior to extraction. The Sephadex column eluates were evaporated and taken up in RIA buffer. Aliquots were incubated overnight at 4°C with a testosterone antibody produced in rabbits. Free and antibody-bound hormones were separated using Somogyi reagents. Radioactivity measurements were made in a Beckman LS-250 counter. Samples were run in duplicate and corrected for recovery.

In the first two ten-day experiments, an initial baseline was established

by having two mission participants follow a behavioral program while residing in the programmed laboratory environment for several successive days. Remuneration was a function of performance productivity on the MTPB. Accurate individual operation of the MTPB produced points which were deposited in a joint account to be divided evenly between the two participants at the conclusion of the experiment. A daily ceiling of ten thousand accuracy points, representing approximately 12-16 hours of total work, was in effect for Group 1, whereas no such ceiling was imposed for Group 2. After three successive days under such dyadic conditions, the third (i.e., novitiate) participant was introduced into the programmed environment. For Group 1, the third participant was permitted to contribute to the other participants' MTPB accumulations, but he was remunerated on a per diem basis without regard to his performance productivity. For Group 2, however, when the third participant was introduced as a group member, the contingency protocol stipulated that only two of the three mission members could work on a given day, and the other (i.e., resting) participant would be remunerated based upon the average MTPB productivity of the two working participants. After four successive days under such triadic conditions in both groups, the novitiate participant was withdrawn from the programmed environment, and the mission continued for three additional days with the original two-person group.

In both groups, the novitiate member showed a gradual, rather than an abrupt, integration into the established work schedule which was left free to vary according to the participants' dispositions. As shown in Figure 28, the novitiate participant (i.e., Subject 3) in Group 1 progressively contributed to the daily performance ceiling until his terminal productivity on Day 7 was equivalent to the other two mission participants. Similarly, as shown in Figure

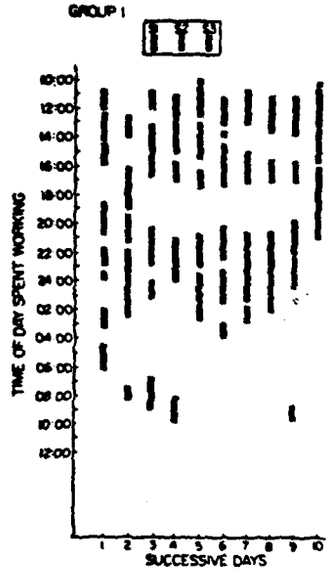


Figure 28. Time of day spent working for all subjects across successive days of the experiment.

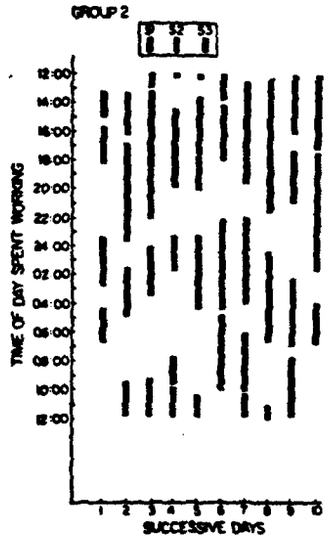


Figure 29. Time of day spent working for all subjects across successive days of the experiment.

29, the two ten-day members in Group 2 refused to allow the novitiate participant to work on Day 4, the first triadic day of the mission, despite that participant's repeated exhortations to be granted permission to work. When the novitiate participant was allowed to work on Days 5-7, he demonstrated daily work productivity not notably different from the two ten-day participants. Taken together, these observations show a significant resistance by an ongoing group to change an established and proven pattern of work even when such a change would have provided relief from operating a demanding task (i.e., the MTPB).

An analysis of testosterone levels obtained from 24-hour total urine volumes collected during both experiments showed striking, though predictably inverse relationships to the experimental manipulation of changing the size and composition of a group. As shown in Figure 30, in Group 1 the testosterone levels of the established two-person group members dropped when the novitiate member was introduced, and they recovered to baseline levels when he was withdrawn. Significantly, the novitiate member's testosterone levels were consistently elevated in comparison to his teammates, and he also showed corresponding elevations on "Dominance" factors associated with the pre-mission screening battery. As shown in Figure 31, in Group 2 the novitiate team member showed clinically diminished testosterone levels, and he also showed the lowest value on the pre-mission "Dominance" scores. These observations show the influence of personal history (i.e., individual difference variables) and role differentiation as assessed from behavioral, endocrine, and psychometric perspectives on the potential personal readjustments and interpersonal challenges that a group must manage successfully when a change in membership occurs. Finally, the elevated testosterone observed in the novitiate in Group 1 and the diminished testosterone observed in the novitiate in Group 2 may reflect

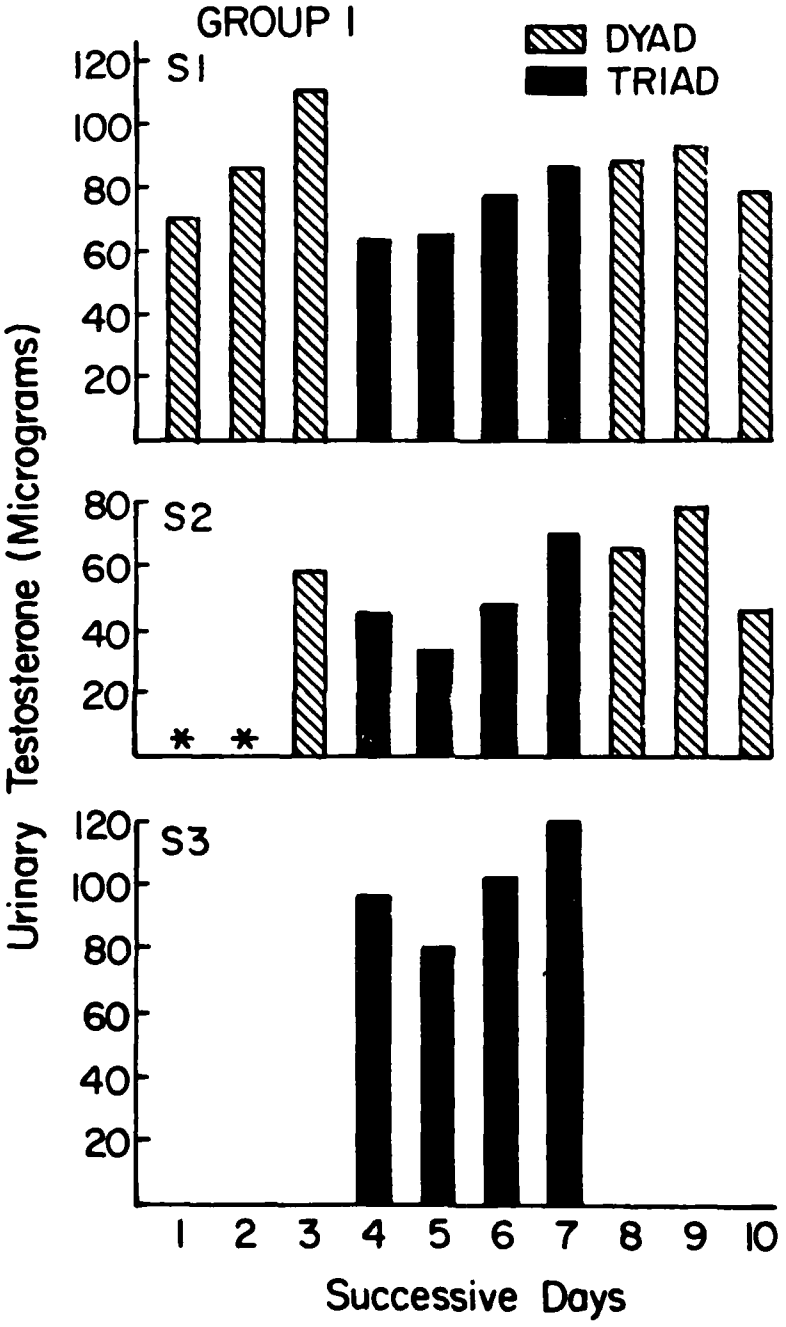


Figure 30. Total urinary testosterone for all subjects across successive days of the experiment. Samples were incomplete on days denoted by "*".

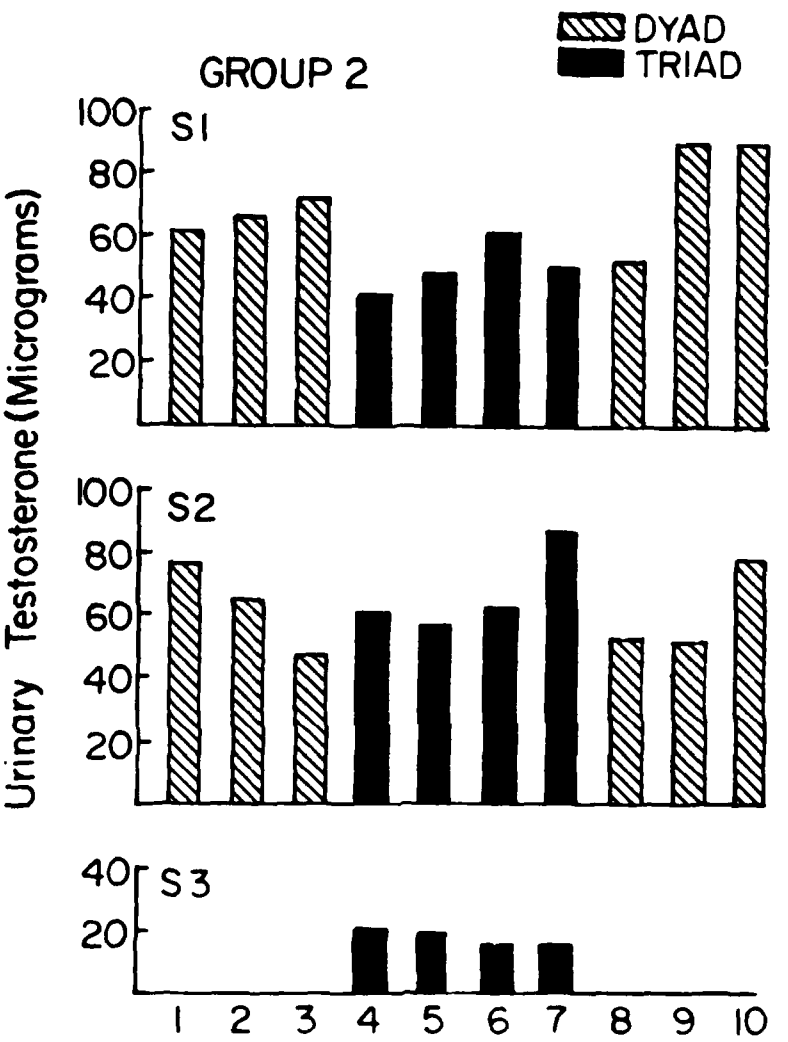


Figure 31. Total urinary testosterone for all subjects across successive days of the experiment.

active processes associated with joining the respective established groups, but the absence of baseline levels precludes such an interpretation.

The third ten-day experiment was designed and conducted to assess further the effects on individual and social behavior of a third participant's introduction into and withdrawal from a previously established and relatively stable two-person social system. This systematic replication of the two previous missions focused upon the social and performance effects associated with the integration of such a participant into the established group and upon sources of group disruption and/or cohesiveness fostered by his presence. Particular experimental attention was also directed to participants' hormonal (i.e., testosterone) levels in relationship to the programmed changes in group membership. The replication involved procedural innovations intended (1) to extend the previous analyses to a somewhat different set of experimental conditions with novitiate participants, (2) to potentiate the outgroup status of the third participant who joined the ongoing two-person group, (3) to demonstrate the reliability and generality of previous results, and most importantly, (4) to provide baseline hormonal levels for the novitiate before and after his participation as a group member.

The two-person group resided for ten successive days within the continuously programmed environment. Participants followed a behavioral program of contingently scheduled activities which determined individual and social behaviors, the latter being available on a non-cooperative basis throughout the study. Separate from the behavioral program was access to the work station containing a multiple task performance battery (MTPB) and a serial learning (SL) task. Accurate operation of the MTPB and SL tasks produced "accuracy points" which were deposited in a joint account to be divided evenly between the two ten-day participants at the conclusion of the experiment and which determined

remuneration for participation.

After four successive days under such dyadic conditions, the third participant was introduced as a member of the group. For three preceding days, this third participant had resided in a private chamber, but his behavioral program lacked communication, social, and work opportunities. This three-day period provided a hormonal baseline against which to evaluate the effects of joining the group. During the next four three-person group days, the novitiate participant was required to operate the MTPB and SL tasks for his individual remuneration, whereas he was paid a fixed per diem on baseline "alone" days. At the conclusion of this four-day period, the third participant left the group for a final two-day baseline period within his private chamber while the established group returned to its status as a two-person team.

The results showed that the novitiate participant intruded himself into the established work schedule on the first triadic day of the mission (i.e., Day 5). As shown in Figure 32, the novitiate, Subject 3, commenced working at 1200 hours on Day 5 which marked the change of day, without communicating his intentions to other mission participants. Thereafter on Day 5, he initiated two additional work periods. As a result of negotiations with the two ten-day participants, the novitiate participant shifted his work episodes to successively later periods of the day across Days 5-8. Finally, the accommodation of the novitiate into the work schedule by the two ten-day participants is suggested by the more frequent sustained work periods exhibited by participants while the novitiate was a member of the group.

A more striking effect of the impact of the novitiate on the status of the social system is revealed by the changes in wake-sleep cycles which occurred when the novitiate joined the group. As shown in Figure 33, time of day spent sleeping during triadic Days 5-8 changed precipitously for Subjects 1 and 3, and

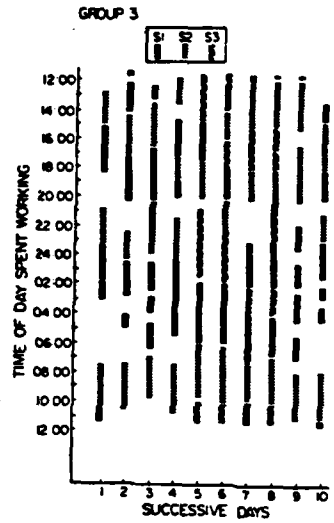


Figure 32. Time of day spent working for all subjects across successive days of the experiment.

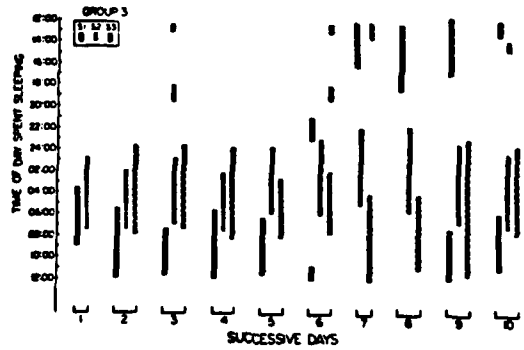


Figure 33. Time of day spent sleeping for all subjects across successive days of the experiment.

remained comparatively undisturbed for Subject 2.

An analysis of testosterone levels obtained from 24-hour total urine volumes collected during the experiment showed changes by two of the mission participants as a function of the two-person and three-person conditions. As shown in Figure 34, Subject 1, a ten-day group participant whose basal testosterone values were low in comparison to standardization parameters, showed increases in testosterone when the novitiate was introduced into the group, and his values declined during the final two two-person days of the mission. Significantly, this participant was the only group member expressing irritation with the novitiate member as determined from interpersonal ratings obtained during the Health Assessment activity. The novitiate participant, Subject 3, who was introduced into the group on Day 5, showed a marked suppression of testosterone across the four three-person days, with a recovery to baseline levels during the last two solitary days of the experiment. Testosterone produced by Subject 2 was stable after a decline across the first two days of the mission. Significantly, Subject 2 showed the least change in his established wake-sleep patterns whereas Subjects 1 and 3 showed pronounced changes. These data suggest that the organization of a social system and its subsequent reorganization under the specified rule conditions impacted upon endocrine system activity as revealed by corresponding changes in testosterone output among mission participants.

In Group 3, the magnitude of the drop in testosterone exhibited by the novitiate in comparison to such values observed during baseline days suggested an active process associated with the joining of the group and emphasized the importance of baseline observations on all mission participants. Accordingly, a fourth experiment was designed and conducted to incorporate procedural changes intended to provide basal hormonal levels prior to both dyadic and triadic group

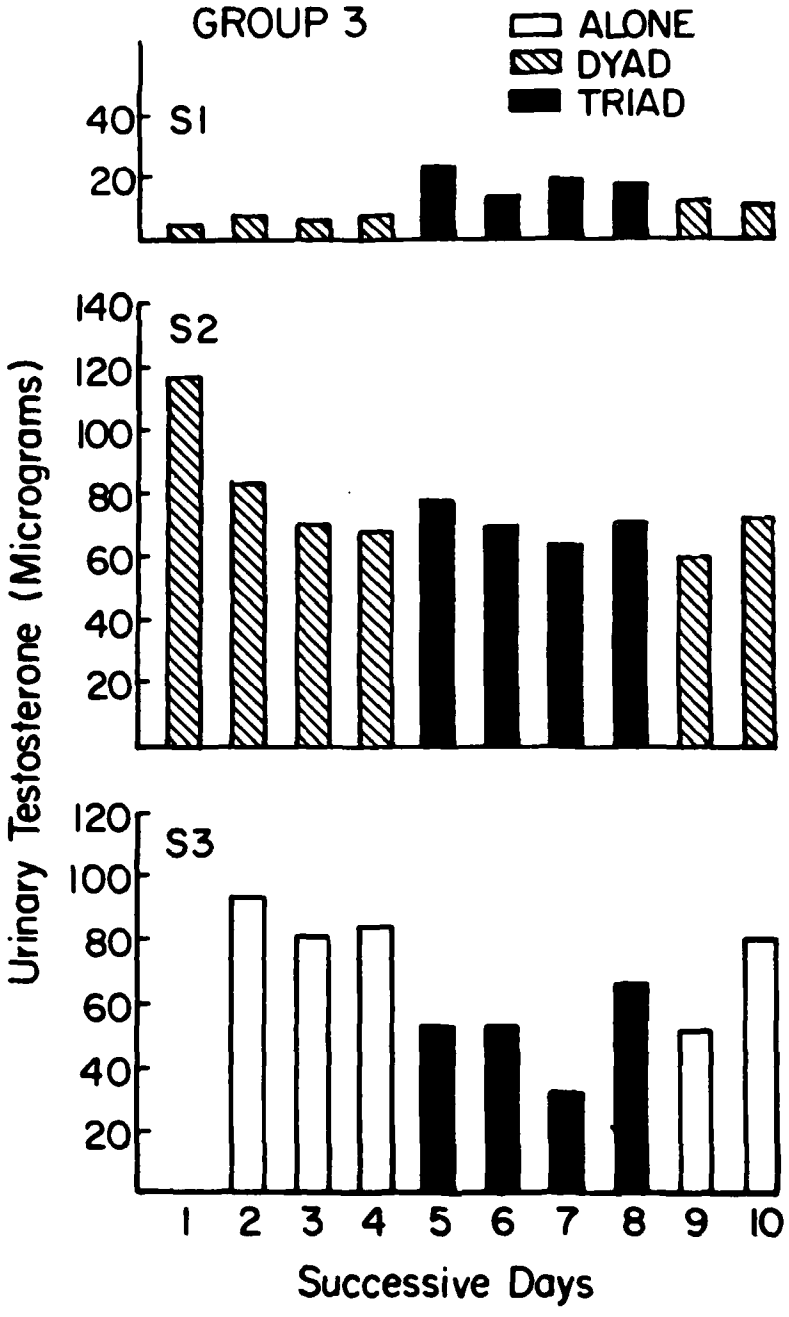


Figure 34. Total urinary testosterone for all subjects across successive days of the experiment.

formation.

In addition to dyadic and triadic social conditions to be described, the ten-day experiment was composed of baseline and work days. On baseline days, mission participants followed a behavioral program in their individual rooms, but without having access to work, intercom communications, or social activities. During such baseline days, subjects received a per diem allowance. On work days, participants also followed a behavioral program which included social activities and intercom communications, and they were additionally required to operate the MTPB for their earnings.

The two-person group participants resided for ten successive days within the continuously programmed environment. Days 1-3 were solitary baseline days, and on Day 4, these participants formed a two-person team with competitive work opportunities. That is, a participant's MTPB accuracy-point earnings were deposited within his individual account which was awarded to him at the conclusion of the experiment. This two-person work condition was in effect from Days 4-6. Also on Day 4, the novitiate participant began his baseline days within his private quarters, remaining under such conditions from Days 4-6. On Day 7, the novitiate participant joined the previously established two-person group. Days 7-10, then, were triadic days with all three participants operating the performance battery on a competitive basis. In summary, the design of this experiment allowed assessment of androgen productivity and behavioral factors under baseline conditions which preceded dyadic team formation and triadic team reorganization.

As shown in Figure 35, the two-person group developed an orderly and alternating sequencing of work intervals throughout dyadic Days 4-6. When the novitiate joined the group on Day 7, this sequencing persisted, but, importantly, the novitiate participant assumed the most preferred work interval

(i.e., 1200-2000 hours). In contrast, Subject 1 worked from 2000 to 0400 hours, and Subject 2 worked during the least preferred time of day (i.e., 0400-1200 hours). Finally, when the novitiate was a grc p member during Days 7-10, the work intervals of the two ten-day participants were longer and uninterrupted in contrast to the more frequent and comparatively briefer intervals observed throughout Days 4-6. Thus, the novitiate participant exerted a pronounced effect on the routine previously established by the two-person group.

Wake-sleep cycles were altered among solitary baseline, dyadic, and triadic days. As shown in Figure 36, sleep periods for the two ten-day participants during Days 1-3 were synchronous with a typical day-night orientation, uninterrupted, and at least 8 hours in duration. During dyadic Days 4-6, however, some disruption in sleep patterns by the dyadic group is evident in response to those members' adaptation to the performance tasks. The most striking change occurred, however, when the novitiate joined the group on Day 7. Throughout Days 7-10, Subject 2 showed a pronounced and consistent shift in his sleep period, Subject 1 showed a moderate adjustment which extended into the early hours of an experimental day (which commenced at 1200 hours), and most importantly, Subject 3 showed no such major alterations in sleep patterns in comparison to his baseline wake-sleep cycles established during Days 4-6.

An analysis of testosterone levels obtained from 24-hour total urine volumes collected during the experiment showed orderly relationships to the observed changes in wake-sleep cycles and work time. As shown in Figure 37, Subjects 1 and 2, the two ten-day participants, showed intermediate testosterone levels across the baseline and dyadic days of the experiment. These levels are comparable to those exhibited by the novitiate, Subject 3, throughout his baseline Days 4-6. When the novitiate participant joined the group on Day 7, his testosterone levels at least doubled, and these substantially elevated

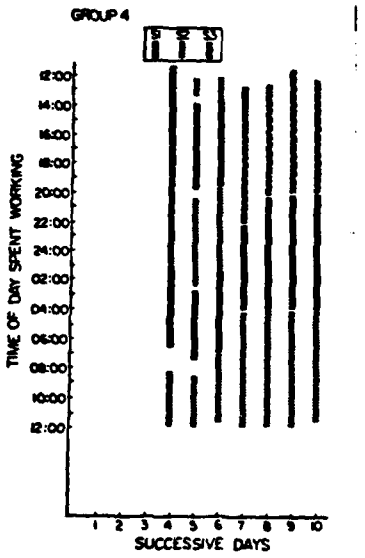


Figure 35. Time of day spent working for all subjects across successive days of the experiment.

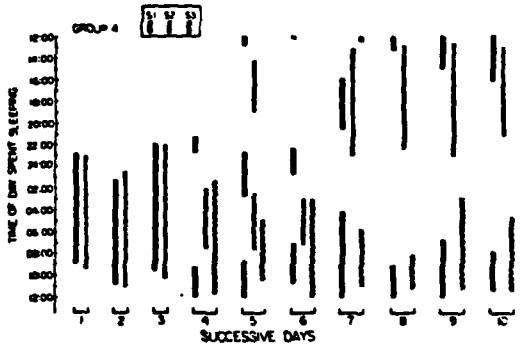


Figure 36. Time of day spent sleeping for all subjects across successive days of the experiment.

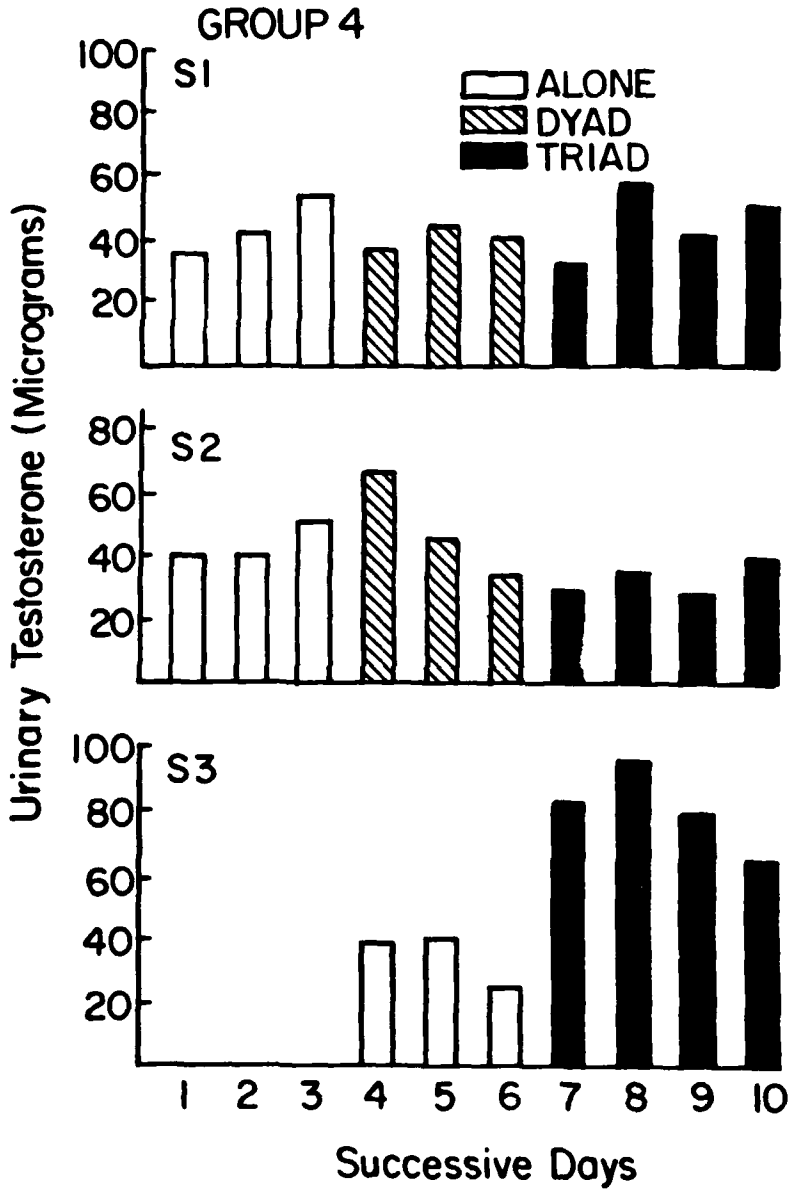


Figure 37. Total urinary testosterone for all subjects across successive days of the experiment.

levels persisted throughout the remaining triadic days of the experiment. In contrast, testosterone levels of the two ten-day participants dropped when the novitiate joined the group, and only Subject 1 showed a recovery to those levels observed throughout the six preceding days.

In summary, then, the participant (Subject 2) who showed the greatest shift in his wake-sleep cycles when the novitiate joined the group also showed a reduction in testosterone throughout the four triadic days of the mission. Conversely, the novitiate participant (Subject 3) who showed the least such shift also showed consistent elevations in testosterone throughout the four triadic mission days.

Because of the consistent relationships observed between changes in testosterone and changes in wake-sleep cycles when the novitiate entered the group in Groups 3 and 4, a fifth experiment was designed and conducted to assess the effects of introducing a novitiate participant into an established group when the program schedule held the sleep period constant for all subjects.

The experimental design plan for Group 5 was almost identical to that for Group 4 with the following constraint in effect throughout dyadic and triadic days. Throughout such work days, access to the work station, intercom, and social room was prohibited between 2400 hours and 0800 hours of each day. This restriction was imposed so that mission participants would likely orient their sleeping to those particular hours, although they always had the opportunity to engage in the many remaining individual activities within the behavioral program. Finally, in contrast to Group 4, the novitiate participant entered the environment on Day 3 for four solitary baseline days prior to his entrance into the group on Day 7.

As shown in Figure 38, when the dyad was formed on Day 4 of the experiment, the two participants (i.e., Subjects 1 and 2) developed an orderly sequential

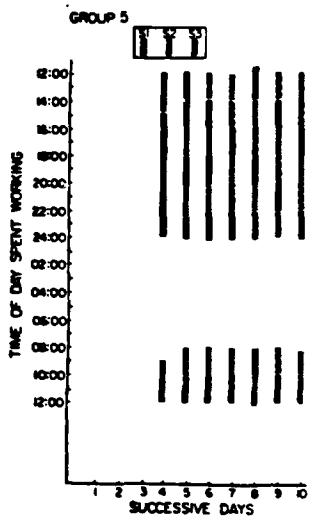


Figure 38. Time of day spent working for all subjects across successive days of the experiment.

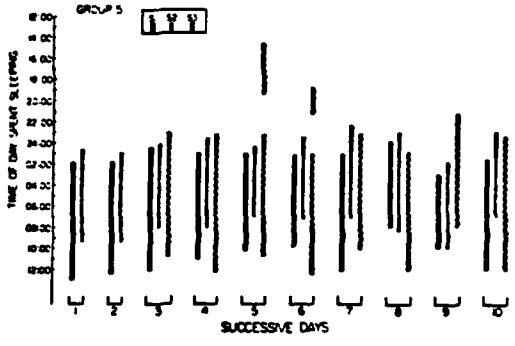


Figure 39. Time of day spent sleeping for all subjects across successive days of the experiment.

pattern of work with each alternating work period lasting approximately 2-4 hours. This pattern persisted throughout dyadic work Days 4-6. When the novitiate entered the group on Day 7, his integration into the group involved his willing adoption of the previously established work pattern. Throughout Days 7-10, the three participants alternated access to the work station with each work period lasting approximately 2 hours and changing at about the same time of day throughout triadic work Days 7-10. Thus, this particular novitiate participant was not observed to cause a major disruption in the style of working which developed preceding his entrance into the group, nor did Subject 1 or 2 try to prevent his recurrent access to the work station.

As shown in Figure 39, wake-sleep cycles were stable for all subjects across successive experimental days. The time of day spent sleeping roughly corresponded to the interval when the activity restrictions were in effect. The only exceptions were observed on Days 5 and 6 when Subject 3 was exempt from the behavioral program because of minor illness, and he napped during the day hours. These data, then, are in striking contrast to the shifts in wake-sleep cycles produced in the previous experiments when the novitiate became a group member.

The uneventful entrance of the novitiate participant and the absence of resistance by the established dyad were paralleled by the lack of notable changes in urinary testosterone across successive experimental days. As shown in Figure 40, no subject showed a consistent and large-magnitude change in testosterone as a function of the dyadic and triadic conditions. (Sampling error prevented Day 10 determinations.) Subject 1's values were low to intermediate, Subject 2's values were intermediate, and Subject 3's values were high. These data then, suggest that irrespective of the variance among participants' baseline testosterone levels, the accommodating and cooperative character exhibited by members of this particular group was sufficient to

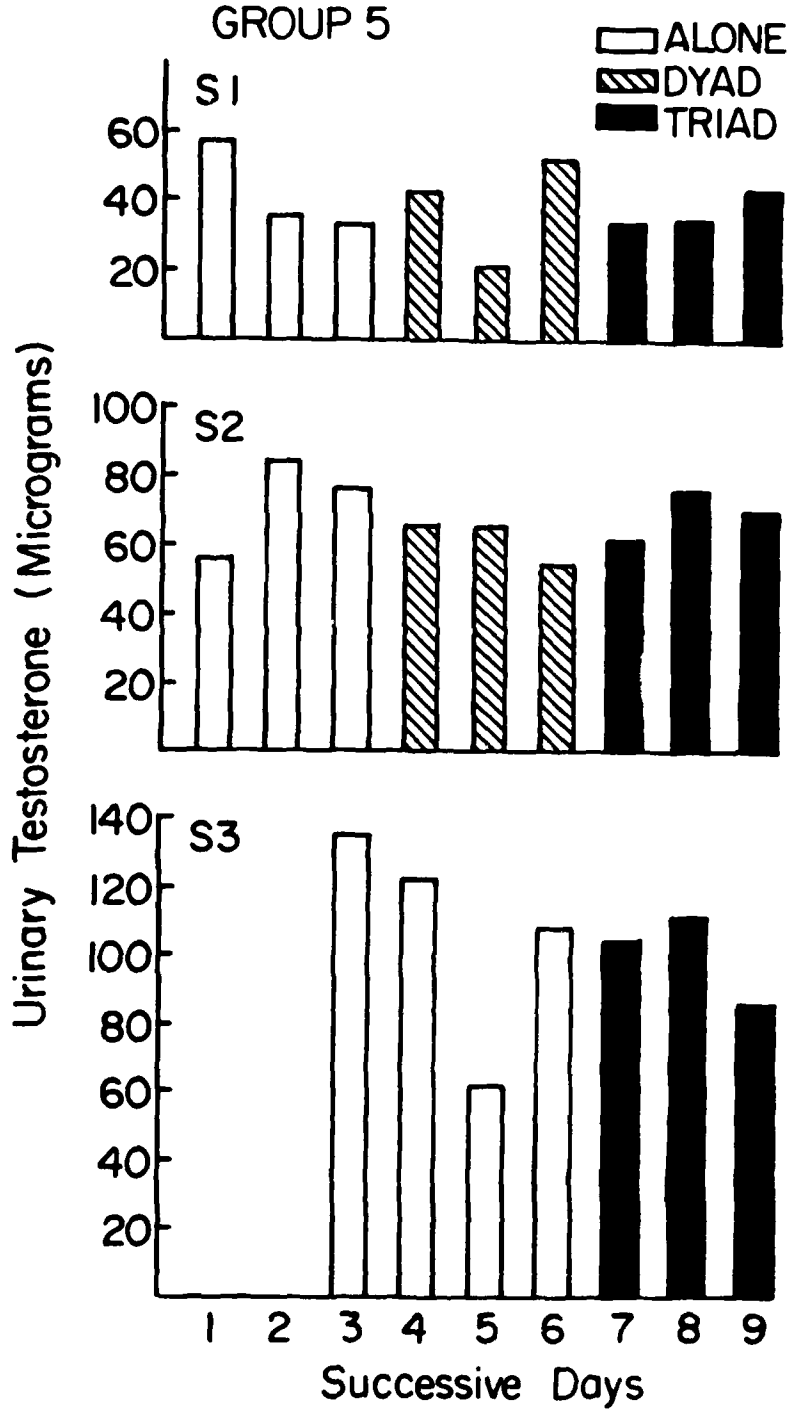


Figure 40. Total urinary testosterone for all subjects across successive days of the experiment.

inhibit confrontations which in previous groups were related to behavioral and hormonal readjustments.

The five previous experiments were undertaken with all-male groups because of the importance of eliminating major sources of intersubject variability during the early phase of a research program. With the completion of Group 5, however, the data base appeared sufficiently robust to warrant an extension of the observed behavioral-biological interactions to a situation involving a mixed-sex group. Accordingly, the sixth experiment within this series, and the last study to be described in this report, involved the introduction of a female novitiate participant into an established two-person male group.

The design plan of this sixth experiment was similar to the one used for Group 3. The two-person male group operated the MTPB for ten successive days, and each participant's accuracy points were deposited within a joint account evenly divided at the conclusion of the experiment. After four successive days under dyadic conditions, the novitiate female participant was introduced as a member of the group. For the four preceding days, this participant had resided in her private room under solitary baseline conditions. After four successive days under triadic work conditions, the novitiate was removed from the group for two final baseline days while the remaining participants again worked as a two-person team. Finally, unlike all previous experiments, the two male participants had previously participated in an earlier study: Subject 1 was a dyadic group member and Subject 2 was the novitiate in Group 4.

As shown in Figure 41, during Days 1-4, Subject 1 worked during the early hours of an experimental day which began at 1200 hours. This is similar to the hours during which he worked in Group 4 on Days 4-6. Importantly, Subject 2 in the present experiment, who was the novitiate in Group 4, was not observed to work during the preferred hours as he had in Group 4 on triadic Days 7-10. On

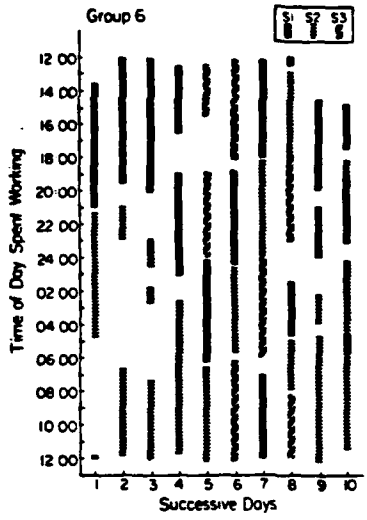


Figure 41. Time of day spent working for all subjects across successive days of the experiment.

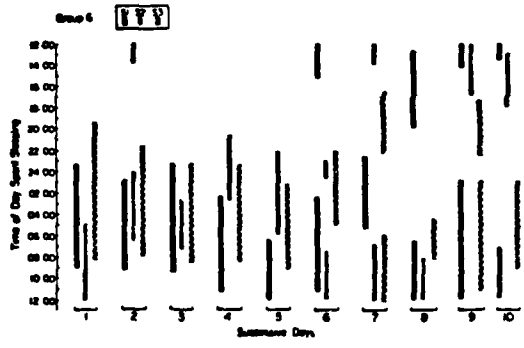


Figure 42. Time of day spent sleeping for all subjects across successive days of the experiment.

Days 1-4 in Group 6, the work period alternations were perhaps not so regular as they were on Days 4-6 in Group 4. When the novitiate participant entered the group on Day 5, she alone worked during the first 12 hours of that day, with Subjects 1 and 2 working during subsequent 6-hour intervals, respectively. Thereafter on triadic Days 6-8, subjects alternated access to the work station, but no stable patterns of such alternation developed, and for all subjects, work periods occurred sporadically throughout the day, rather than being oriented to a specific time of day across successive days of the triadic condition. Finally, when the novitiate left the group at the end of Day 8, the work sequences for Subjects 1 and 2 roughly corresponded to those observed during dyadic Days 1-4.

As shown in Figure 42, no subject maintained consistent wake-sleep cycles across successive days of the experiment. Although such cycles were comparatively regular during Days 1-4 when Subjects 1 and 2 worked as a dyad and Subject 3 lived alone under baseline, when the novitiate entered the group on Day 5, wake-sleep cycles were thereafter erratic on triadic Days 5-8. When the novitiate left the group at the end of Day 8, wake-sleep cycles did not show an abrupt return to a typical day-night orientation. Importantly, Subject 2, the novitiate in Group 4, did not successfully maintain his wake-sleep cycles over successive experimental conditions as he was observed to do when he was a member of Group 4.

An analysis of testosterone obtained from total urine volumes collected throughout the experiment was notable for the absence of large-magnitude changes across successive experimental conditions. As shown in Figure 43, Subject 1 shows values consistently intermediate across successive experimental days. Importantly, these values are similar to those observed when he was a participant in Group 4 (see Figure 38). Subject 2, the novitiate in Group 4 who

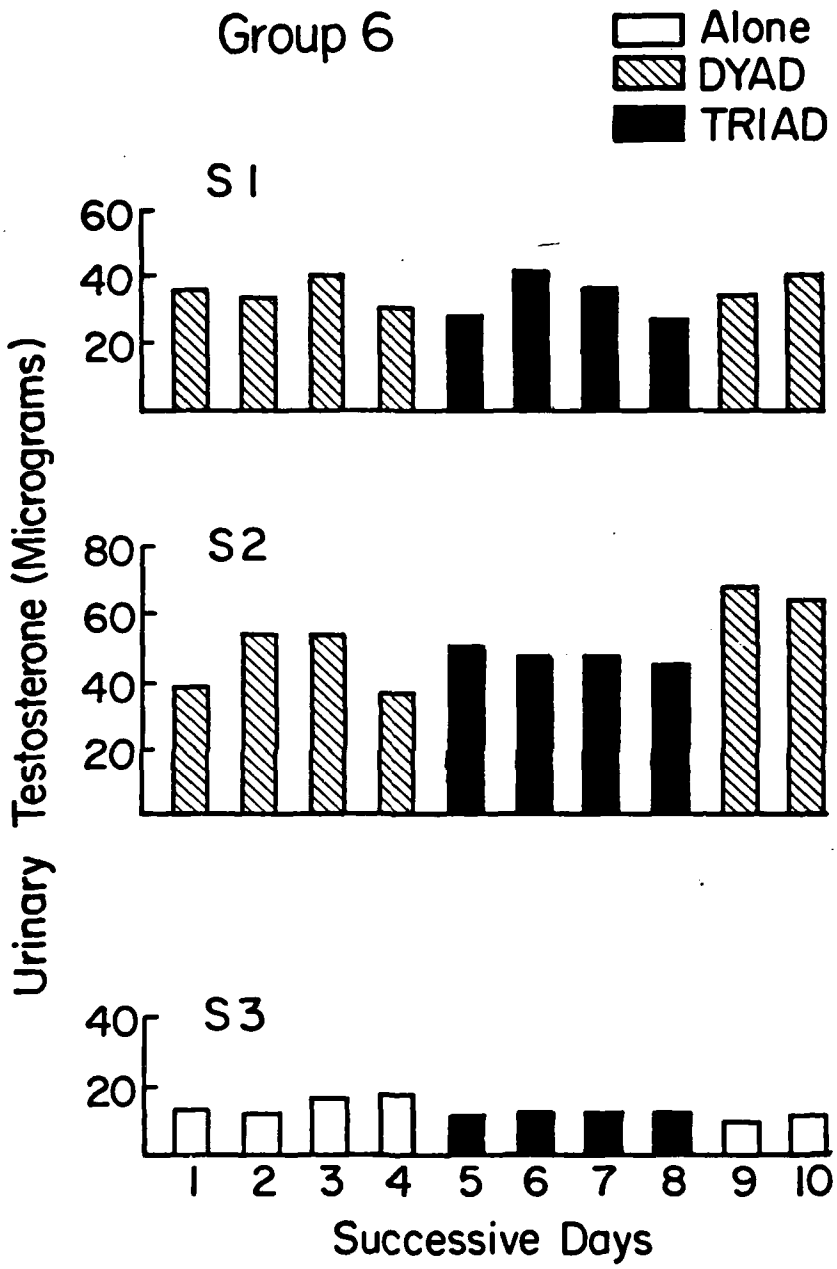


Figure 43. Total urinary testosterone for all subjects across successive days of the experiment.

showed marked elevations in testosterone when he joined the group, failed to show comparable elevations when the female novitiate joined the group on Day 5. Significantly, in the present experiment, Subject 2 did not maintain his established wake-sleep cycles as he was observed to do when he was a member of Group 4. Subject 3, the female novitiate, showed a slight drop in testosterone across Days 5-8 in comparison to values observed during baseline Days 3-4. Finally, given the turbulent character of subjects' work intervals and wake-sleep cycles which contrast with the relative constancy of the hormonal measures, these data suggest that this particular group failed to resolve issues of leader-follower relationships which might have otherwise been reflected in the endocrine domain.

The results of these latter experiments show clearly that interactive behavioral and biological processes are prominently involved in the individual performance adjustments and social adaptations of small groups in a confined microsociety. Of particular interest in this regard are the findings which implicate the programmed environmental and behavioral interactions in at least those aspects of endocrine regulation reflected in the cortisol and testosterone measurements. While the positive relationship between corticosteroid levels and individual work productivity is generally consistent with the "catabolic" influence presumed to be exerted by these hormones on energy metabolism (Mason, 1968), the interactions between androgen levels and both individual and group performance dynamics present a more complex interpretive problem.

In this latter regard, for example, the sensitivity of testosterone levels to changes in group composition was most evident in those groups in which work routines and/or wake-sleep schedules were disrupted for some members but remained stable for others. More specifically, success in gaining or maintaining access to a work schedule least disruptive of established wake-sleep

routines was generally accompanied by elevations in testosterone levels occasioned by changes in the group composition (e.g., S2, Group 3; S3, Group 4). Conversely, decreases in testosterone levels were associated with changes in group composition that occasioned shifts to less than optimal work and/or sleep schedules (e.g., S3, Group 3; S2, Group 4). Significantly, the participants in Groups 5 and 6 showed little or no androgen response to the programmed changes in group composition. For Group 5, this outcome was consistent with the orderly transition in work routines and the absence of changes in wake-sleep cycles which accompanied the introduction of a new member into this group. In Group 6, however, no member emerged who clearly and persistently provided direction in structuring the transition between a two-person and three-person group, and the members' wake-sleep cycles were erratic.

The suggested interaction between broadly defined "dominance-submission" relationships and testosterone levels in the present series of studies conforms well with the observations reported on changes in group composition and organization in lower primates. Under conditions which involved the introduction of a new rhesus monkey into an existing group, changes in testosterone levels among high-ranking males were observed to be functionally related to an animal's success (or failure) in defending his status in the primate social order. Victorious animals showed significant increases in testosterone levels (Bernstein, et al., 1974) while monkeys defeated by the group were reported to show marked androgen level decreases (Rose, et al., 1972). These general relationships between the "dominance-submission" hierarchy and testosterone levels in subhuman primates were further confirmed in experiments which involved the merging of two established groups, with defeated alpha males showing a decrease and victorious alpha males an increase in androgen levels (Bernstein, et al., 1979). It must be emphasized, of course,

that these studies with laboratory monkeys occurred under conditions which involved intense and enduring aggressive confrontations unlike anything observed in the much more benign exchanges among the humans participating in the present group interaction experiments. The general conformity in environmental-endocrinological relationships described under these two somewhat disparate investigative circumstances, however, suggests a continuity across species of these fundamental behavioral-biological interaction processes.

It is, of course, both premature and hazardous to speculate on the implications of the present findings for the analysis of group performance effectiveness under confined microsociety conditions. With regard to the relevance of the interactive endocrinological relationships observed under such conditions, however, it seems reasonable to suggest that the adaptive significance of any hormonal response can best be understood in terms of the consequences of that response at the metabolic level. Although metabolic research on the androgens has been largely confined to reproductive functions, it is well established that testosterone has potent "anabolic" properties, promoting protein synthesis in muscle and many other tissues (Dorfman & and Shipley, 1964; Kochakian, 1964) and potentiating some effects of insulin on carbohydrate metabolism (Talaat, et al., 1957). Whether these "anabolic" effects of testosterone and the androgenic metabolites play any appreciable part in general organic or energy metabolism must, of course, await clarification by further investigative analysis. But at the very least, the present series of experiments emphasize the importance of a multidimensional analysis of the behavioral and biological interactions which determine the adaptations and adjustments of small groups in confined microsocieties.

C. Summary and Conclusions

The objectives of this research on small group performance have focused upon the development of principles and procedures relevant to the selection and training of mission personnel, upon the .nvestigation of preventive monitoring and corrective procedures to enhance mission performance effectiveness, and upon the evaluation of behavioral and physiological countermeasures to the potentially disruptive effects of unfamiliar and stressful environments. Initial research activities were directed toward the design and development of an experimental microsociety environment for continuous residence by small groups of human volunteers over extended time periods under conditions which provided for programmable performance and recreational opportunities within the context of a biologically and behaviorally supportive setting. Studies were then undertaken to analyze experimentally (1) conditions which sustain group cohesion and productivity and which prevent social fragmentation and individual performance deterioration, (2) motivational effects produced by programmed consequences of individual and group performance requirements, and (3) behavioral and physiological effects resulting from changes in team size and composition. The significance of these investigative endeavors is to be understood in terms of emergent motivational and social-interaction principles of practical relevance for the establishment and maintenance of operational mission performance effectiveness.

The results obtained from these small group studies clearly established the applicability and generality of behavioral technologies and methodologies to the experimental analysis of individual and team performance within the context of a human microsociety. The development of behavioral programming techniques was demonstrably effective in generating and maintaining such individual and group performances for monitoring and measurement with precision and regularity over

extended time periods. Importantly, the application of fundamental contingency management principles and the technological guidelines which provided the basis for design and development of the programmed microsociety environment have been shown to sustain individual performance effectiveness and team cohesiveness without notable biological or behavioral disruption under conditions of spatial restriction, social separation, and enforced intimacy.

More specifically, the results of these studies have shown that both individual and group productivity can be enhanced under such confined microsociety conditions by the direct application of contingency management principles to designated high-value component tasks within the overall performance program. Similarly, group cohesiveness can be promoted and individual social isolation and/or alienation (i.e., group fragmentation) prevented by the application of contingency management principles to social interaction segments of the performance programs, and measures of participation in group activities under confined microsociety conditions were shown to be related to the degree to which individual alienation or withdrawal occurs when circumstances require "pairing" performances.

Conditions which have been found to result in the progressive deterioration of individual and team performance effectiveness include aversive programming contingencies, such as avoidance of criticism or punishing events. The by-products of aversive schedules which emerge under such circumstances were found to be detectable and quantifiable in measures of verbal performance (e.g., behavioral program assessment ratings), interpersonal performance (e.g., diminished productivity), and group morale (e.g., irritability and dysphoric mood). Moreover, positive incentive contingency management was demonstrated to counteract effectively the disruptive consequences of such aversive programming contingencies while at the same time supporting high work productivity free from

negative side-effects.

Related research results emphasized the prominent involvement of behavioral and biological processes which are functionally related to adjustments when changes occurred in group membership composition and size. The experimental analysis of such "introduction" effects emphasized the critical importance of providing a structured transition in the form of orientation and training regimens for both novitiate and established team participants to minimize potentially disruptive performance effects of altering the interpersonal and social dynamics of a confined microsociety.

Motivational and social-interaction principles derived from the research would appear to be relevant to the initial establishment and long-term maintenance of operational mission performance effectiveness. In particular, selection procedures for mission participants should capitalize upon the benefits derived from evaluations of individual performance effectiveness under continuously programmed environmental conditions. Team interaction assessments should also form an integral part of selection criteria under environmental programming conditions emphasizing social interaction contingencies. Moreover, training procedures for both individual and team performances should be undertaken within the context of the powerful "learning-performance" applications of contingency management principles in highly programmed environmental settings.

Mission programming schedules should also be based upon detailed behavior analyses of performance-chaining sequences to insure that the opportunity to engage in "high strength" activities is contingently related to the prior occurrence of essential work tasks and that the performance of such work tasks occurs under positive incentive conditions. Finally, both training and performance productivity can be enhanced by the application of appropriately

programmed contingency management principles which minimize aversive control procedures and provide flexible work-rest cycles determined on the basis of performance effectiveness and individual and team program preferences.

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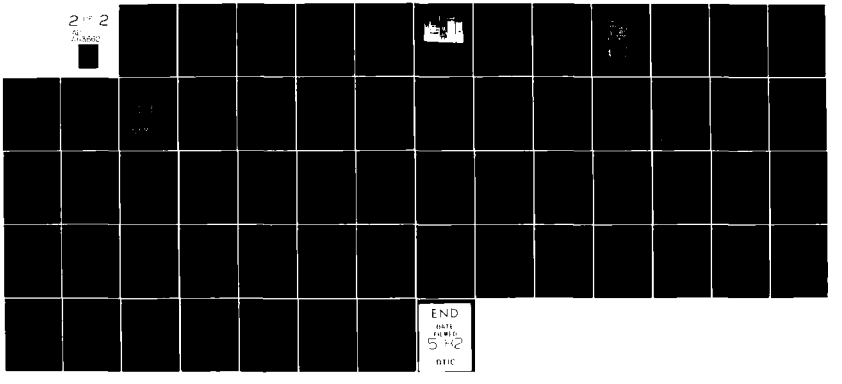

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APPENDIX A

METHODOLOGICAL NOTES ON PROGRAMMED ENVIRONMENT RESEARCH

METHODOLOGICAL NOTES ON PROGRAMMED ENVIRONMENT RESEARCH

This is to provide a narrative and annotated description of the methodology for conducting research studies within a laboratory environment which is programmed for continuous residence by small groups of human volunteers. The design features of this laboratory have been described within two papers (Brady, Bigelow, Emurian, and Williams, 1974; Bigelow, Emurian, and Brady, 1976). Nowhere, however, have the many incidental and anecdotal details been presented, details which are absolutely essential for any research program and without which the laboratory facility would almost certainly stand vacant. Assuming some prior familiarity with the laboratory facility and the behavioral programming procedures, these details, then, will be described from the perspective of staff members who carry the responsiblity of implementing experimental design plans which are independently formulated by several senior investigators.

The core staff consists of one full-time investigator, two full-time research assistants, and several part-time investigators. These numbers are supplemented by at least six part-time assistants, almost all of whom have been undergraduate students. (Only one student has been a psychology major with career goals in psychology.) The part-time assistants help to monitor the experiments, and they are rarely needed at other times. Several days prior to the start of an experiment, these "monitors", as they have come to be known, meet with the two full-time assistants to review the design protocol and to arrange monitoring schedules.[1] To provide around-the-clock supervision of an experiment, there are three 8-hour shifts per day: 8:30 AM to 4:30 PM, 4:30 PM to 12:30 AM, and 12:30 AM to 8:30 AM. These times were chosen for the monitors' convenience of using a free shuttle service between a local college, where most monitors attend, and the inner-city clinic where the laboratory is located. The two full-time assistants always occupy the 8:30 to 4:30 shift, and the part-time monitors the remaining shifts. The part-time monitors decide among themselves how to schedule coverage of the various shifts, and there has never been a serious problem covering even the overnight period. In fact, much to our surprise and relief, if not dismay, many students

1. The following people have participated as monitors: Joseph F. Abate, George E. Bigelow, Peter S. Bigham, Janet R. Brice, Roger Cox, Christopher J. Danielewski, Cheryl A. Davis, David J. Francis, Charles H. Gaskins, Jr., Lois Imber, Robn Hargrove, E. Katherine Hodges, Dennis Leone, Jerry Locklee, Thomas Locraft, Joan Marie Morton, Gregory Orloff, Felicia Pharr, Janice A. Plotczyk, Ellen Reichenbach, Lisa Reichenbach, Anthony F. Rock, Margaret C. Ross, Sandra Rossie, Sharon White, Peter Whitehouse, and Duen Yen.

show a strong preference for the overnight time. This may be attributable, at least in part, to the mutual understanding that one monitor may sleep if only one subject is awake in the program, and to the best of our knowledge, this is what happens. Monitors are paid by the hour, and the remuneration is sadly nominal because without the dedication of these people, there would never be an experiment.

Monitors vary in the number of consecutive days they wish to work during an experiment. Some monitors insist on working the same shift every day, whereas others work only several experimental days, and they vary the shifts. This results in a welcome flexibility of response if the schedule needs to be changed suddenly in case of sickness or whatever. An experiment has never been terminated because of scheduling constraints or lack of personnel, and only very rarely has a core staff member had to substitute for a vacancy on one of the other shifts. Being a monitor has not been a detrimental influence on the students. Many of them have gone on to graduate or medical schools after having worked with us for several years.

For three-person studies, two monitors are always on duty within the control room which is located in a room adjacent to the laboratory. The work is typically divided between a "left-side monitor" and a "right-side monitor", each of which has evolved distinct and complementary roles over the course of the years. Both monitors face the instrumentation consoles presented in Figure 1.

The left-side monitor has the job of observing where the subjects are located in the behavioral program and of granting "permission" for a subject to proceed from one activity to the next. These determinations are made by scanning the several closed circuit television screens which provide selected views of each room in the laboratory. Each subject has a file of small metal cards (5 x 7 in) portraying abbreviations for each activity in the behavioral program. When a subject selects an activity, he displays the corresponding card in the private room at a fixed location which makes it easily visible to the monitor and to the subject himself. The monitor, then, can readily and continuously determine where each subject is located in the program with a single glance, since the screens for the three private rooms are mounted one above the other just above the desk. This inexpensive, flexible, and, in its simplicity, esthetically pleasing method has worked flawlessly throughout dozens of experiments, and it rivals in effectiveness the most complex computer technologies in the laboratory.

The left-side monitor also records the choice of activity on a ruled page divided into three 30-line columns, one column for each subject, and each line is labelled with consecutive minutes of a half-hour period. Had the subject been ineligible for that activity, either failing to have completed the minimum requirements of the immediately preceding activity or inadvertently skipping a sequentially programmed activity, permission for the choice would have been denied by a rapid blink of the room lights which indicates to the subject that an error has occurred. As an example of a correct choice, had subject 1 chosen Health Check at 11:07 AM, the monitor would write H✓ beside 11:07 in subject 1's column. As an example of an incorrect choice, had subject 2 chosen Work Two without having closed his lounge chair used during Food One, the lights would blink when the subject tried to change the activity card, and permission to proceed would thereby be denied until the lounge chair was closed. Each column on the page is wide enough

Figure 1. Pictorial representation of the laboratory support facility which provides for experimental monitoring, programming, recording, and data analysis.

(i.e., about 2 in) for noteworthy events to be entered directly on the page which is changed every thirty minutes. Figure 2 presents one such page of the data records taken from a recent experiment. Usually, only eight hours of pages are kept in a notebook on the monitoring desk at a time. The resulting master log has several important merits: (1) all events associated with an experiment are in one place, (2) a minute-to-minute record of the experiment results with all three subjects side-by-side for comparisons, and (3) the record is not susceptible to data loss from an equipment failure.

The right-side monitor has the job of activating the devices which make resources and tasks available to the subjects in accordance with the rules of the behavioral program. Access to all major resources within the rooms is restricted in the sense that electronic locks prevent resource use until the appropriate activity in the program has been chosen. Figure 3 presents a photograph of the locking mechanisms for one stack of drawers; similar mechanisms are used for all other electronically locked facilities. The electronic locks, which are normally closed, are energized by panel switches on the control consoles (see Figure 1), and the switch array for each room resembles the schematic format of the behavioral program. When the left-side monitor has granted permission for a subject to proceed in the behavioral program, which is implicit unless an error has occurred, the right-side monitor latches the corresponding switch on the console and releases the preceding one. The latched switch unlocks all resources associated with the particular activity. For example, the switch associated with Manual Behavior unlocks the corresponding drawer and activates the hot and cold water in the kitchen. Since each latched switch is illuminated, the right-side monitor also is able to observe continuously where each subject is located in the behavioral program. The switch closures in the array also activate computer interface cards which permit on-line per-unit-time (e.g., every 10 min) "event records" of the progression of activities for each subject.

It is our belief that it is a good policy to minimize, if not to eliminate, the extent to which subjects have direct control over resource access, in the sense of having the electronics initiated by them, because great havoc can occur if subjects are rapidly and simultaneously advancing through the behavioral program with procedural errors. The maintenance of environmental control by the experimenters is compatible with the maintenance of contingency control of a subject's repertoire, and it prevents adventitious drift in the behavior.

In addition to operating the control console, the right-side monitor also activates a microprocessor controlling the Physical Exercise activity, a minicomputer controlling a multiple task performance battery (Emurian, 1978), digi-bits controlling signal lights to the subjects and a Lindsley lever, and a microprocessor recording physiologically generated data, i.e., heart rate, skin temperature, skin conductance, and frontalis EMG obtained during certain work activities in the program. This monitor also handles all exchanges of materials between the subjects and the experimenters: delivering food, requisitioned items, and music tapes and retrieving trash and urine collection containers. The right-side monitor also operates a teletype to transmit any necessary communications to a subject's CRT.

During social activities, when all subjects are together in a recreation room, both monitors view the closed-circuit television screens surveying the room. Every 5 min, a 10-sec observational sample occurs during which

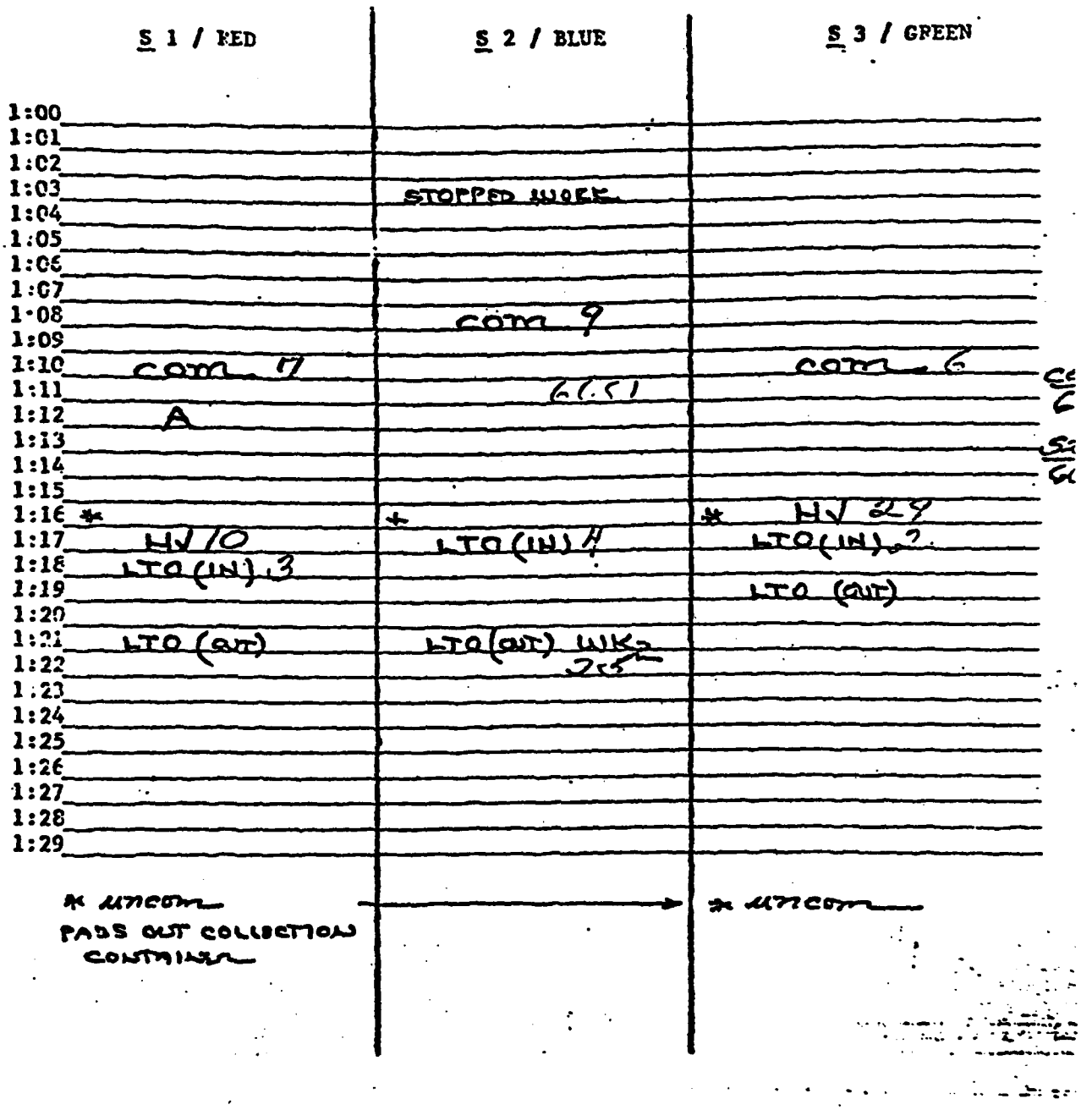


Figure 2. A page of the data records taken from a recent experiment.

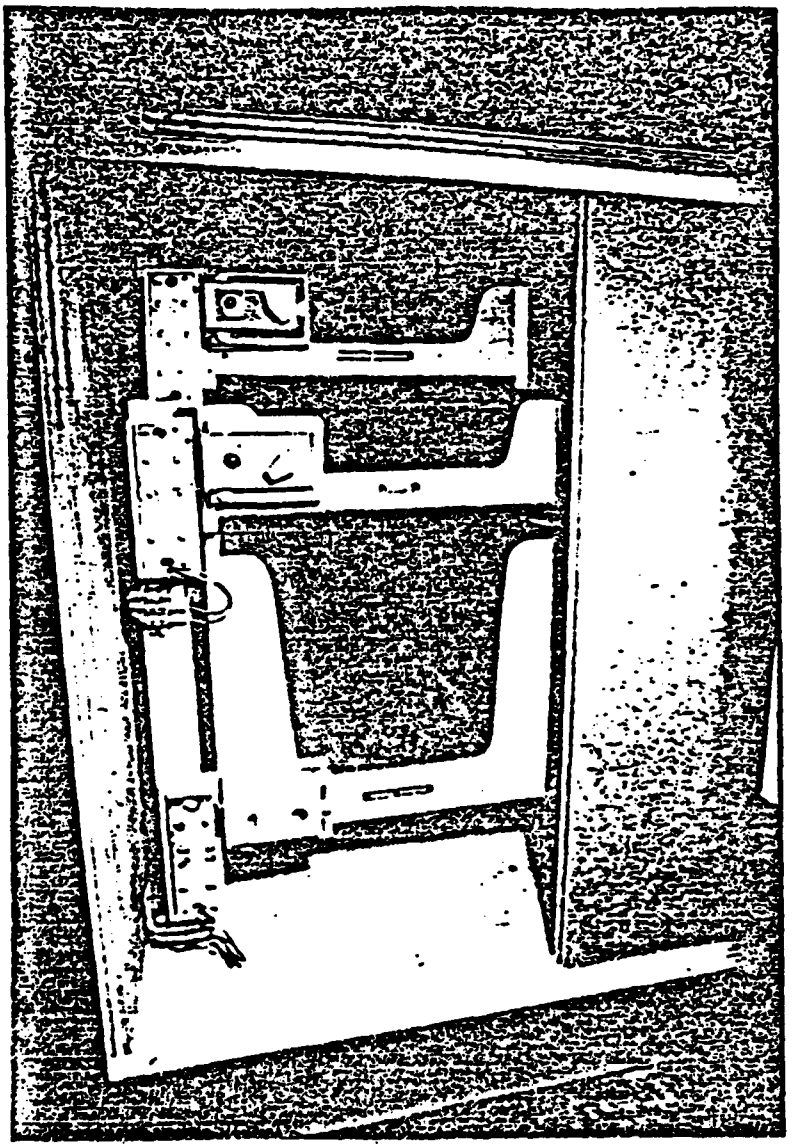


Figure 3. A photograph of the locking mechanisms for one stack of drawers having the following three functions from top to bottom, respectively: Reading activity, Work Two activity, and General Charging. The drawers are "two-way" in that they allow exchange of materials between the subjects and the experimenters, and the locks prevent unauthorized use of their contents.

each monitor independently rates the occurrence of vocal utterances and social games on one form, presented in Figure 4, and scores the subjects' positions in the room for social distance determinations on another, presented in Figure 5. The monitors also take notes of the subjects' conversations, the games they use, and their mood.

Appendix A-1 presents an operators manual that both monitors use during the experiments. The manual is "keyed" to the behavioral program switch consoles. For each activity in the program, the manual provides the following information: (1) what the right-side monitor must do when the activity is selected, (2) what the subject must do to satisfy the minimum requirements of the activity, (3) what the right-side monitor must do at the conclusion of each activity, and (4) any special instructions associated with the activity. The symbol ● in the "AFTER ACTIVITY" column indicates that the monitor must make some exchange of materials with the subject, e.g., remove a completed health questionnaire from a drawer. The second part of the operator's manual, which describes the behavioral program and the activity requirements, is itself identical to the manual used by subjects in a recent experiment.

There are many unreported but significant details associated with the performance requirements and the resource opportunities of several activities in the behavioral program, and they will be presented next as they appear within the fixed or optional activity sequences.

Within the fixed activity sequence, the Health Check activity requires the subject to complete a series of questionnaires and to report several observations of his physical status as indicated in the H✓ form presented in Appendix A-2. The Physical Exercise activity requires the subject to reach and press switches located in four positions (2 high, left and right; 2 low, left and right) on one wall of each private room. Lights behind the switch in each location indicate which switch is to be pressed. Accurate performance requires that the illuminated switch be pressed within 1.5 sec of its illumination, and the subject must accumulate 500 accurate presses to complete the activity requirements. The task produces a rhythmic calisthenic exercise which a practiced subject can complete with very few, if any, errors or pauses.

Within the optional activity sequence, the Reading activity provides access to books and other textual material of the subject's choice. Subjects may bring their own material to the laboratory, or they may make selections from the laboratory's small collection of books. It is our experience that despite the best of intentions, almost no serious studying is accomplished during the Reading activity, and student subjects are fully advised of this fact. Novels are the preferred reading material, and even subjects who originally select testbooks often switch to novels later in an experiment. The Work Two activity requires the solution of a variety of tasks, usually work problems or mazes which require 20 - 40 min to complete. Figures 6 and 7 present typical tasks presented during Work Two. The Puzzle Assembly activity requires the subject to assemble a small jigsaw puzzle (7 x 7 in) similar to the one presented in Figure 8, and the subject receives a different puzzle on each successive selection of the activity. Nineteen puzzles are available for this activity, and very rarely has a subject twice been presented with the same puzzle during the course of a 10- to 15-day experiment. The Manual Behavior activity provides access to art materials contained in a drawer whose contents are listed in Table 1. The Private Games activity provides access to a drawer

SAMPLE #	ACTIVITY	DAY	TIME	INTERACTION CATEGORIES	INITIALS
				SUBJECT 1 SUBJECT 2 SUBJECT 3	
265	FD3	9	7[15] PM	VOCAL GAMES (VOCAL GAMES) (VOCAL GAMES) S2 SAYS PE/ WAKES YOU UP EVEN IF IT IS A PAIN.	RGH
266	FD3	9	7[20] PM	VOCAL GAMES (VOCAL GAMES) (VOCAL GAMES)	RGH
267	FD3	9	7[25] PM	VOCAL GAMES (VOCAL GAMES) (VOCAL GAMES) S2 SAYS EXCEPT FOR OCCASIONAL MOMENTS OF FRUSTRATION IT IS NOT THAT BAD IN HERE — HE IS SURPRISED. S3 AGREES	RGH
268	FD3	9	7[30] PM	VOCAL GAMES VOCAL GAMES VOCAL GAMES	RGH
		9	7[35] PM	VOCAL (VOCAL GAMES) VOCAL	

Figure 4. A completed form for rating occurrence of vocal utterances and social games.

270	FD3	9	7[40] PM	GAMES (GAMES) GAMES	RGH

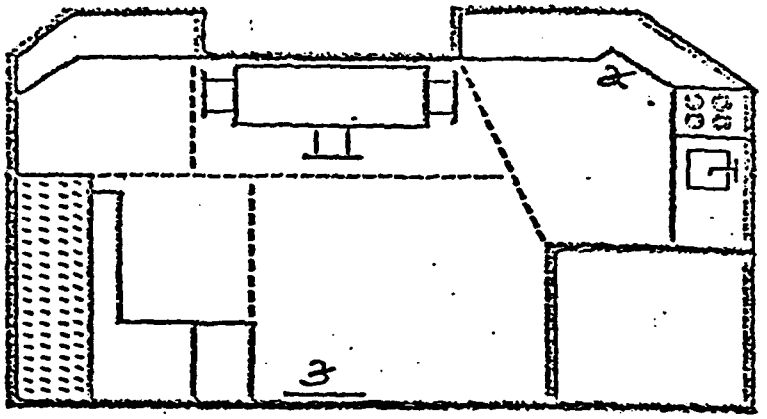
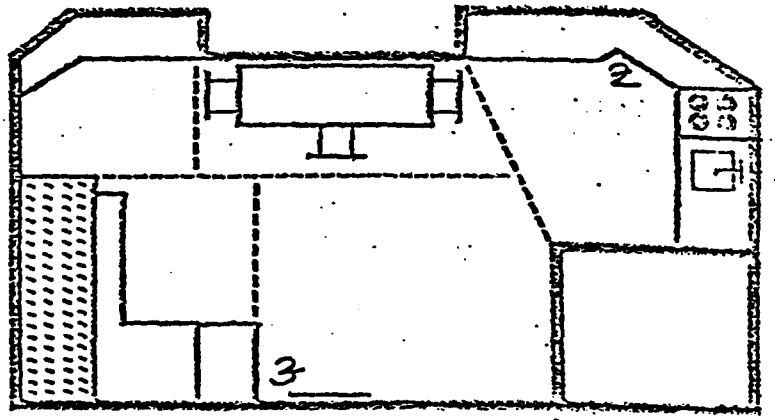
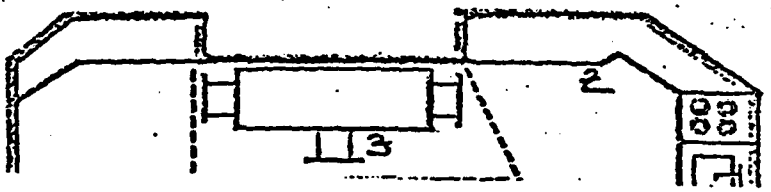
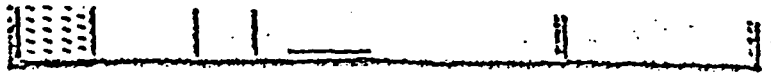
SAMPLE #	
265	
266	
	

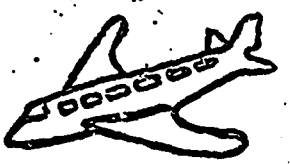
Figure 5. A completed form for social distance determinations.



PUZZLE 36

ZANY WORD

ON THE ROAD



Actually, this Search-and-Find gridword is about more than road transportation. It covers the whole spectrum of transport on land, sea and air. There are 38 words in all.

AIRPLANE
AMBULANCE
AUTOMOBILE
BARGE
BUS
CAB
CAMEL
CANOE
CARRIAGE
CART
COMMUTER TRAINS
DHOW
ELEVATOR
FEET
GLIDER
HORSE
JET
JINRIKISHAS
JUNK
KAYAK
KUFA
LLAMA
LOG
MULE
OCEAN LINERS
OXEN
RAFT
SHIPS
SKIS
SLEDS
SUBWAY
TANK
TANKER
TRACTOR
TRAIN
TRAVOIS
TRUCK
WAGON

C O M M U T E R T R A I N S A
A C A R R I A G E K U F A E U
N E E R A O Y T Z R E L C L T
O A N E V G A E N W K G W E O
E N A K K A W E Q O S N R V M
H L L N G C B F K U G X A A O
G I P A E N U T B X C A R T B
O N R T S G S R Y T R C W O I
L E I T R L U A T F O A F R L
T R A V O I S C R A X M U L E
B S J D H D K T A R E E P X S
K A Y A K E I O I M N L J D H
H D H O W R S R N I A E E C I
U E C N A L U B N A S L T A P
J I N R I K I S H A S M L B S

Figure 6. A typical word problem presented during Work Two.

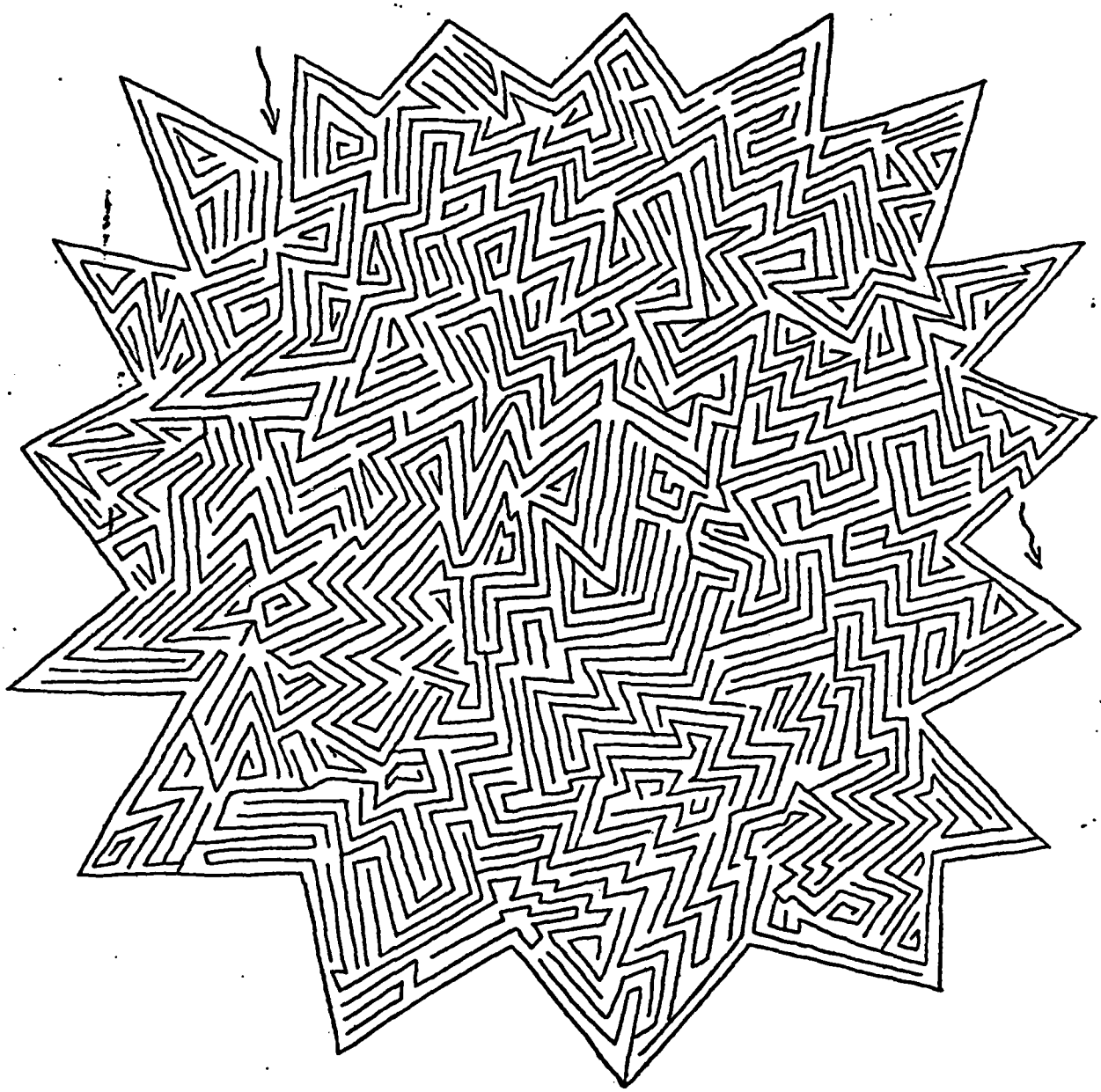


Figure 7. A typical maze presented during Work Two.

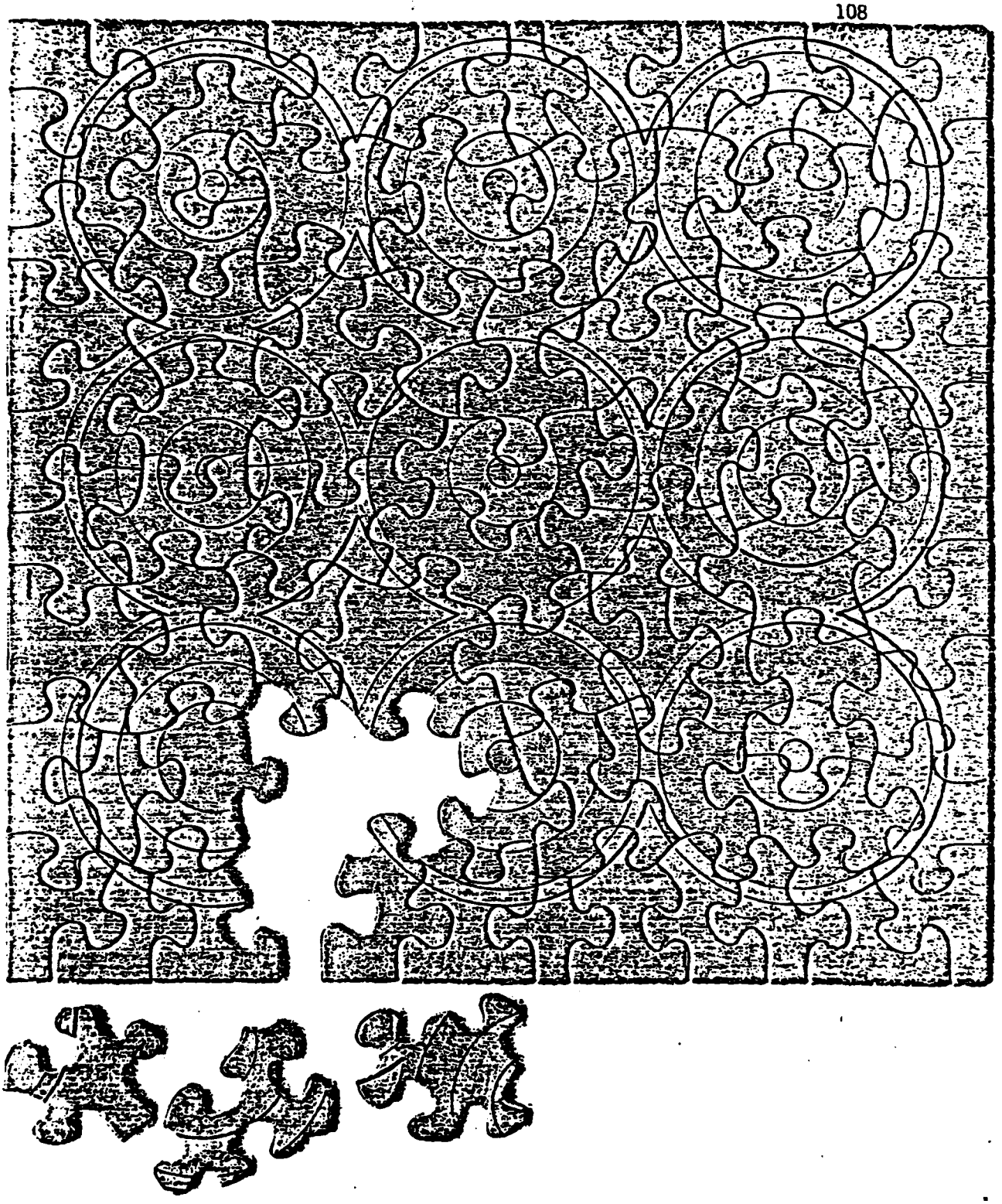


Figure 8. An example of one of the puzzles available for the Puzzle Assembly activity. The puzzle has several colors.

TABLE 1

Contents of the Manual Behavior Drawer

1 Tablet of news stock paper (18 x 24 in)
2 Art sketch books (11 x 14 in and 18 x 24 in)
1 Sketch book (9 x 12 in)
1 Pck. assorted colors construction paper
1 Tablet lined paper (8.5 x 11 in)
1 Set of 6 tempera poster paints
1 Set of water colors
1 Pck. of colored flairs (10)
1 Pck. of colored pencils (18)
1 Pck. of pastels (12)
1 Box crayons (16)
2 Mars-lumograph drawing pencils
1 Charcoal pencil
1 Mechanical pencil
1 Large magic marker (black)
1 Large eraser
1 Pencil sharpener
4 paint brushes (assorted sizes)
1 12 in ruler
1 Bottle glue
1 Pair scissors
2 Water cups
1 Box thumb tacks
1 2 lb pck. of modeling clay
1 clay knife

of solitary games which are presented in Table 2. The contents of the "GAMES" cabinet located in the social recreation room are listed in Table 3. It is our experience that under conditions of isolation and confinement, at least, subjects receive much satisfaction and pleasure in working with these simple puzzles and games which are interesting, varied, and challenging, but never overwhelming in complexity.

In summary, the information presented in this paper complements the more formal, and in some important ways less complete, presentations of the methods and procedures which have evolved over the past several years for conducting research studies in a programmed laboratory environment. The intent has been to focus upon the many unreported but significant details associated with such studies so that behavioral programming procedures will more readily fall within the interest and scope of other investigators.

TABLE 2

Contents of the Private Games Drawer

1 Invisible ink quiz and game book
1 Home run baseball game (pinball baseball)
1 Hi-Q
1 Krazy Quilt
1 Fascinating 15
2 Puzzle Squares
1 Ski Slope Brain Teaser
1 Great Train Robbery Brain Teaser
1 Re-stacking discs on wooden pegs game
1 Eight-men puzzle
1 Cube puzzle
6 Link puzzles
1 Deck of cards
1 Yo-yo

TABLE 3

Contents of the Games Cabinet

Chess set
Checkers
Backgammon
Scrabble
Monopoly
Clue
Parcheesi
Outdoor Survival Game
Tobruk
Marble solitaire
Dominoes
Peg-out
Four decks of playing cards
Carrousel of poker chips
Pinball game
Three Nerf balls
One Nerf Frisbee
Dartboard with six darts
Punching bag and gloves

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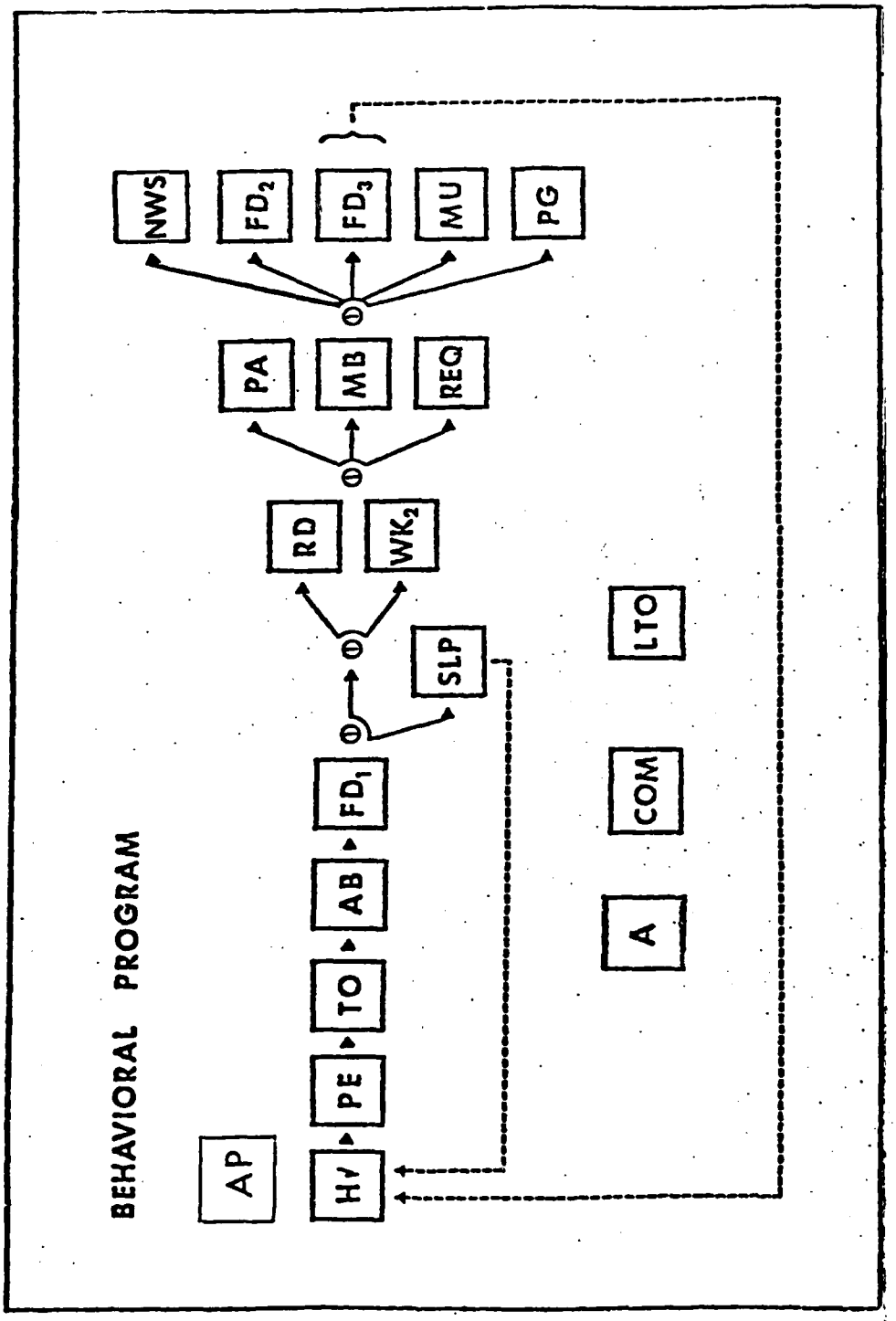
APPENDIX A-1

OPERATOR'S AND PARTICIPANT'S MANUAL

NUMBERS EXP 43



ACTIVITY	MONITOR	S's MINIMUM REQUIREMENT	AFTER ACTIVITY	SPECIAL INSTRUCTIONS
H✓	Press [H✓] Press [GC]	Place completed form in General Charging Drawer	Press [H✓] ● Remove H✓ form from General Charging Drawer Press [GC]	
PE	Press [PE] Microprocessor: Press E Press B Press S's #	500 Correct Responses (Task will stop when S reaches criterion)	Press [PE] Record S's score beside PE notation in data book. (R=000*000) Do not allow S to repeat sequence.	If PE light burns out: 1. Press E 2. Press C 3. Press S's number (1, 2, or 3). This turns on all lights. After S repairs unit: 1. Press C Task will continue. If you start wrong room: 1. Press E 2. Press A 3. Press wrong room (1, 2 or 3)
TO	Press [TO] Press FRIG	Subject displays ▨ card, Monitor turns on signal light. Subject can proceed.	Press [TO] Press FRIG	
AB	Press [AB]	Play tape	Press [AB]	

ACTIVITY	MONITOR	S's MINIMUM REQUIREMENT	AFTER ACTIVITY	SPECIAL INSTRUCTIONS
FD1	Press FD1 ● Charge foods in Food Drawer. Turn on signal light Turn off signal light	Display selection or XX cards Close lounge chair	Press FD1	
SLP	Press SLP	30 minute minimum Close bed cover and curtain	Press SLP	
RD	Press RD	30 minute minimum Close lounge chair cover	Press RD	
WK2	Press WK2 Press GC	Return completed task to General Charging Drawer	Press WK2 Press GC ● Charge WK2 Drawer	
PA	Press PA ● Put puzzle in plastic box, put box in Gen. Charging drawer. Press GC Turn on signal light Turn off signal light	Assemble puzzle and return it to General Charging Drawer	Press PA Press GC ● Remove puzzle from General Charging Drawer	
MB	Press MB	30 minute minimum	Press MB	

ACTIVITY	MONITOR	S's MINIMUM REQUIREMENT	AFTER ACTIVITY	SPECIAL INSTRUCTIONS
REQ	Press [REQ] Set counter at 500 Turn on work light Press [GC] Turn off work light after S stops work	Earn 1 point	Press [GC] Remove REQ form if subject orders an item ● Charge REQ item Press [GC] Turn on signal light Turn off signal light (after S retrieves item) Press [REQ] Press [GC] Record points Zero counters	20 points is maximum earned in any 1 REQ activity
FD2	Press [FD_2] ● Charge meal in Food drawer Turn on signal light Turn off signal light	30 minute minimum Close lounge chair	Press [FD_2]	
FD3	Press [FD_3] ● Charge meal in Social Room Food Cabinet Traffic Procedure: Turn on signal light Press [DR] Unlock Corridor Door Unlock Soc. Rm. Door Unlock Soc. Bath Door Turn off signal light	30 minute minimum	Press [FD_3] ● Remove trash Press [DR]	Not required to be social activity S may hang XX under FD3 if no meal is desired NOT AVAILABLE ON ISOLATION DAY

ACTIVITY	MONITOR	S's MINIMUM REQUIREMENT	AFTER ACTIVITY	SPECIAL INSTRUCTIONS
NWS	Press [NWS] ● Charge newspaper in General Charging Drawer Press [GC] Turn on signal light Turn off signal light	30 minute minimum Close lounge chair Return newspaper to General Charging Drawer	Press [NWS] Press [GC] ● Remove newspaper from General Charging Drawer	
MU	Press [MU] Set counter at 2500 Turn on work light Press [GC] Turn off work light at end of ratio ● Charge cassette Turn on signal light Turn off signal light	2500 Responses Wait for oassette to be delivered	Press [MU] Press [GC] Zero counters	Do not charge new cassette until old cassette is discharged
PG	Press [PG]	30 minute minimum	Press [PG]	

ACTIVITY	MONITOR	S's MINIMUM REQUIREMENT	AFTER ACTIVITY	SPECIAL INSTRUCTIONS
COM	Press [COM]	Display COM card	Press [COM]	Record (in) & (out), and who called whom: COM is free, BUT NOT AVAILABLE ON ISOLATION DAY
LTO	Press [LTO] Press FRIG	Display LTO card	Press [LTO] Press FRIG	
AUDIT	Press [A] Turn teletype to LINE Hold CONTROL key (CTRL) and press BELL key (G) to create beeps Type message Turn teletype off	Display A card	Press [A]	Audit may occur at any time

AP ACTIVITY (NOT AVAILABLE ON ISOLATION DAY)

Display of AP card indicates that subject wants to work on the Alluisi Program.

If another subject is using AP, press "Activity Unavailable" light.
If activity is available:

Press [W]. "W" stands for "work".

Traffic procedure:

turn on signal light
press [DR]
when applicable:
unlock corridor door
unlock workshop room door
unlock work bath door
turn off signal light

To turn on the AP:

Press red "A"--computer will print "WAIT", followed by "TASKS ON"
when the tasks are displayed.
(Record on card S's last activity.)

When subject is finished, traffic him/her back to room:
press red "A"--total points will be printed out
record final points earned on daily sheet
reset counter: Press button on counter face
label subject's number on data printout

After activity:

press [GC]
retrieve point card and assessment; stamp both with time clock;
place assessment in S's file box, card in adjoining container.
press [GC]
press [W]

UNSCHEDULED COMMUNICATION PROCEDURE

1. Turn on [CRT] for the S(s) with which you want to communicate.
2. Turn teletype to LINE.
3. To advance a line, hit "line feed" key.
   To get to left side of page, hit "return".
4. Hold CONTROL (CTRL) KEY while pressing BELL (g) KEY to creat beeps (3).
5. Type message.
6. Turn teletype off.
7. Turn [CRT] (s) off.

** If you make a typographical error just keep going. You cannot erase.

GENERAL INSTRUCTIONS AND REMINDERS FOR MONITORS:

(See Special Instructions concerning COFFEE on next page.)

SMOKING: Left Side: Record CIGARETTE SMOKING in data book with (S).
Right Side: See that smoking data is printing out O.K. in hall. At noon record new day on printout.

TIME STAMP all Health Reports, essays, work reports, pt. confirm. cards, REQ forms, etc.--Anything where a time reference would be useful should be stamped so that after the experiment we will know when it happened.

TAPE RECORDER: Check when subjects are in COM. If a tape has almost run out, turn it over or replace it. Be sure to label the recorded side: Date and Time. To restart, press "Record" and "Play" simultaneously. The tape will move automatically whenever a subject uses the intercom.

COM is now free in all our experiments (at least until further notice), so left-side monitor must remember to mark "(IN)" and "(OUT)," and who called whom.

Right-side Monitor: Please remember to record on MENU CARDS in monitors' kitchen, as you fix FD2 or FD3,which meals subjects ate--also record their fruit, cereals and soups. This avoids duplications and helps with shopping. Making notes of subjects' food and drink idiosyncrasies and letting us know when supplies are running low are also very helpful.

URINE data will be collected (bottles will be collected once a day--at 12 noon--from the private chambers, and anytime a subject goes back to his room from the social bath).

The sequence of activities that you will follow is presented on the behavioral program diagram. The behavioral program is composed of both a fixed activity sequence and optional activity sequences. The fixed activity sequence is composed of all activities between and including Health Check (H✓) and Food One (FD1). That is, once you have selected H✓ you must then complete the following activities in the order displayed: Physical Exercise (PE), Toilet Operations (TO), Autogenic Behavior (AB), and Food One (FD1).

When you have completed Food One, you may select one of the following three activities: Sleep (SLP), Reading (RD), or Work Two (WK2). If you choose Sleep, the dotted line on the diagram originating below the SLP notation indicates that after you have completed Sleep, you must return to the Health Check acivity and continue with the fixed activity sequence. If you do not choose Sleep, you may select one of the following two activities: Reading (RD) or Work Two (WK2). At the completion of the selected activity, you may then select one of the following three activities: Puzzle Assembly (PA), Manual Behavior (MB), or Requisition (REQ). At the completion of the selected activity, you may then select one of the following five activities: Newspaper (NWS), Food Two (FD2), Food Three (FD3), Music (MU), or Private Games (PG). At the completion of the selected activity, you must return to Health Check and proceed with the fixed activity sequence, as the dotted line originating after the last column of activities indicates.

Activities within the behavioral program may be selected only with

respect to their sequential order. You may not skip an activity, nor may you reverse the order of selections. You may select

the Alluisi Program (AP) only if you are between two activities within the behavioral program. After you have completed AP, you must return to the point in the behavioral from which you departed. However, you may select Limited Toilet Operations (LTO) at any time during the behavioral program. The requirements which are associated with each activity displayed on the behavioral program diagram are fully explained in the accompanying instructions.

Associated with each activity within the behavioral program is a card that must be displayed whenever you select that activity. These cards are stored within a file box on the desk. To select an activity, you must display on the hook on the cabinet beside the bed the card corresponding to that activity. Only one card should be displayed on the hook at a time with the exception of the LTO card. When you select Limited Toilet Operations, hang the LTO card over whatever activity card is currently displayed. Remove the LTO card when you have completed Limited Toilet Operations and have returned to that activity in which you were previously engaged. Whenever you display a new activity card indicating selection of that activity, return the previously displayed card to the file. When you display an activity card, environmental resources and response requirements related to that activity are in effect. An activity card should always be displayed on the hook.

Two participants will spend ten days in the experiment, and the

remaining two will spend five days each. For the two 10-day participants, earnings during nine "working" days will be determined by operating the AP task located within the workroom. Each point is worth 1¢. The points earned by each person will be deposited in an individual account which will determine his earnings for participating in the experiment. The first five-day participant will have five "working" days, the second will have four.

Three subjects will enter the experiment on day 1. From the beginning of day 1 through the end of day 5, AP, COM and FD3 activities will be available, and subjects must operate the AP task for their earnings.

At the end of day 5, the subject who has earned the fewest AP points will leave the experiment, and a fourth subject will enter at the beginning of day 6. On day 6 all three subjects will remain in isolation in their rooms. During this one-day period the AP task will not be available, and subjects will not have access to the intercom (COM) or the social room (FD3). On day 7 the AP, COM, and FD3 activities will again become available for the remainder of the experiment, and subjects must operate the AP task for their earnings.

You may use the Audit card (A) to learn the number of points the other subjects have earned within a 24-hour period. Display the Audit

card and a report of your and the other subjects' point values for that 24-hour period will soon be displayed on the CRT screen.

It is a good idea to keep a record of your earnings.

By using the Audit, you can also keep a record of the other subjects' earnings.

Some activities, e.g., food, require the experimenters to place materials in certain drawers after you have selected them. After you have selected such an activity, wait for the signal light on your work panel to illuminate before retrieving materials from the drawer. This signal light also serves as a feedback light during activities where you must pull the work lever. You should recognize that this light serves both as a signal light and a work feedback light at different occasions within the behavioral program.

Some activities require you to spend a minimum amount of time within them before you may proceed to another activity. You may spend as much additional time as you wish beyond the minimum time requirements.

The overhead lights within the private chambers are controlled by two dimmer switches. You may fully extinguish the lights above the bed at any time. You may fully extinguish the remaining overhead lights only during the Sleep activity. You may dim the lights at any time, but the activity card must be visible.

Please do not lie down on the bed covers. You are not permitted to sleep during any activity other than Sleep, and the privacy curtain must

remained pulled back at all times other than the Sleep activity.

Failure to comply with the behavioral program, instructions, or requirements related to any activity will cause the overhead room lights to be extinguished briefly. This event is intended to provide prompt information about errors, inadvertent or otherwise, rather than punishment of any sort. If the lights are extinguished and you are unable to determine the cause, please reread the activity instructions and/or these preparatory paragraphs.

Please adopt a deliberate approach to solving errors or encountering unforeseen circumstances. If events go awry, don't panic or become overly disturbed. Simply make the best decision you can, and continue with the program. Of course, you are expected to follow the instructions as carefully as you can, and the experiment will be terminated if any subject conspicuously and flagrantly violates the procedure. Further, you are free to terminate the experiment at any time, and the emergency exit doors are always available for this purpose.

From time to time, it may be necessary for the experimenters to make unscheduled communications with you. These communications usually occur to inform you of an equipment problem or to clarify misunderstanding in the protocol. An unscheduled communication will be signalled by several beeps on the CRT, after which the message will appear on the screen. You may reply, if necessary, and you will be heard over the audio monitor.

Total urine volumes will be collected during this experiment as explained to you in the orientation. Your cooperation in the collection procedures will be appreciated and is crucial for the interpretation of results.

HEALTH CHECK (H✓)

Supplies necessary to complete this activity are located within a drawer below the bed labeled Health Check. The drawer will unlock soon after you have displayed the card. The requirements associated with this activity are satisfied when you have completed the following ten items:

1. Record your name in the labeled blank space at the top of the LOMS SUBJECTIVE STATUS REPORT.
2. Complete the LOMS SUBJECTIVE STATUS REPORT and the ENVIRONMENTAL QUALITY CHECK LIST as the instructions indicate thereon.
3. Shake down the glass thermometer to a level below the average body temperature (98.6). Determine you current body temperature by keeping the glass thermometer under your tongue for 3 minutes measured with the stop watch. Record your temperature in the labeled blank space, shake down the thermometer.
4. Count your heart beats for 15 seconds, multiply this number by 4, and record this latter number in the labeled blank space.
5. Weigh yourself without your shoes, and record your weight in the labeled blank space.
6. Record the current time in the labeled blank space, and estimate the number of days that you could continue to live comfortably in this experiment irrespective of its planned duration.
7. Complete the SLEEP REPORT if applicable.
8. General comments may be recorded in the GENERAL COMMENTS section.
9. Complete the PROGRAM EVALUATION FORM.
10. Place the completed questionnaire in the General Charging drawer. Return all materials to the Health Check drawer.

Your care in answering all parts of the questionnaire will be greatly appreciated because of the importance of subjects' reactions to

the laboratory.

During the second H✓ of every 24-hour period, in addition to completing the forms, we would like you to write a paper of at least 250 words in length about an interesting or dramatic personal life experience you have had. Please write the paper in one sitting (i.e., do not write for awhile, quit, and then finish the paper later). Also, we would like you to write about a different experience each day. Do not duplicate your stories. When you have finished, put the paper with the completed H✓ form in the General Charging drawer.

PHYSICAL EXERCISE (PE)

This activity requires you to press switches mounted on the wall as they are illuminated at random. When one of the four switches is illuminated, you have a brief time period in which to press it to register a correct press. A corect press will turn the light off, produce an audible "beep", and turn on another switch light. An incorrect press, or one that is too slow, will simply extinguish the light and turn on another one without a beep. You must complete 500 correct presses to satisfy the requirements of this activity. Correct presses will increment the amount registered on the counter mounted on the wall between the upper and lower right-hand switches. This counter will reset automatically to zero when you have completed 500 correct responses.

After you have displayed your PE card, the first switch light will be illuminated following a delay; please wait patiently for the first light. No additional lights will appear after you have completed 500 correct presses. When your counter resets to zero and no additional switch light appears, the requirements for this activity have been satisfied.

If a switch lamp burns out while this exercise task is in progress, power will be supplied to all lamps simultaneously. The dark switch contains the burned out lamp. Use your repair kit to remove the two screws holding the switch in its base. Gently remove the switch, unplug the power cable, and replace the bulb. Plug in the cable and replace the

switch. The exercise task will then proceed to operate.

If a counter jams or fails initially to increment, continue to operate the task. You will know that the task has been completed when no new switch light appears, and you are permitted to proceed to the next activity.

Please use only your hands and fingers to press the switches. Furthermore, please do not strike the switches too hard. If a switch mechanism jams or breaks while the task is in progress, replace it with the spare one in your repair kit.

TOILET OPERATIONS (TO) 

This activity provides access to all bathroom facilities and to the contents of the Toilet Operations drawer. When you display the TO card, the bathroom door will unlock following a delay. The area adjacent to the bathroom is completely private and out of view of the TV monitor. If you shower during this activity, you may place your clothes and towel on the bed cover next to the private area. First regulate the water temperature with the sink outlets before you activate the shower nozzle by turning the plastic pointer. Steady the water temperature slightly on the cool side to avoid discomfort from local pressure variations. The shower nozzle may be removed from its holder above the sink. Before you shower, remove the toilet paper from its holder, and place it outside the bathroom. Return the toilet paper after you shower.

During this activity, you may use the vacuum cleaner located in the cabinet beside the bed. At the completion of this activity, all materials not permitted to be retained must be returned to the TO drawer.

To terminate this activity, display the transparent LINE card over the TO card. After a brief delay, the signal light will illuminate indicating that you may proceed to another activity.

AUTOGENIC BEHAVIOR (AB)

Items necessary to complete this activity are contained within a drawer below the desk labeled Autogenic Behavior. Remove the tape from the drawer, insert it into the recorder, and follow the instructions. The 10-minute relaxation exercise is most easily and comfortably done lying on the rug with your head resting on the cushion. You must play the entire taped instructions to satisfy the minimum requirements associated with this activity, even if you do not follow them. However, please try to attend closely to the instructions because they probably will help you feel calm and refreshed. You must play the tape loud enough to be heard over the audio monitor. To complete this activity, rewind the tape and return it to the drawer. If the tape recorder malfunctions during this activity beyond your capacity to repair, proceed to the next activity; your recorder will be repaired automatically at a later time or a spare one will be delivered through the General Charging Drawer.

FOOD ONE (FD1)

This activity provides the opportunity to select two different food items from the list of numbered items:

1. Hot cereal with milk and sugar
2. Cold cereal with milk and sugar
3. Fresh fruit
4. Milk
5. Soup
6. Waffles and syrup
7. Eggs
8. Bread with butter and jelly

Your card file contains numbers corresponding to the above list and two X's. Display on the hooks those cards that correspond to the food items that you desire. The signal light will illuminate when the food items are available within the food drawer, but you must not try to open the food drawer before it illuminates. The signal light will extinguish automatically sometime later during the food activity. If you desire only one food item, display an X card adjacent to the selected numbered card. Although you may save food items delivered during FD1, you may consume those food items only during FD1 or FD2. If you desire no food, display both X cards on the hooks and wait for the signal light to illuminate before proceeding to another activity.

Please be prepared for a brief delay before the signal light illuminates whether or not you have selected food items. This activity also provides access to the stove, refrigerator, kitchen sink hot and cold water, and the utensils. You may use the lounge chair during this activity, but the cover must be closed before you proceed to the next activity. Finally, you must remove and store the numbered and/or X cards before you proceed to another activity.

SLEEP (SLP)

This activity provides access to the bed and the sheets, pillows, and blanket. Raise the covers of the bed, and be sure that they are securely locked in place. Sheets, blanket, and pillow for your use are located within the cabinet above the desk. To put the sheets on, it helps if you slide the whole mattress out toward the bathroom door so you can reach the back corner of the mattress. You may, of course, turn out the chamber lights during this activity and use the curtain around the bed. If you use the LTO during SLP, turn on the lights to make the activity card visible.

When you want to terminate the SLP activity, return the sheets, blanket, and pillow to the cabinet, and lower the covers to the bed. Be sure that the curtain is fully drawn back and retained with the rope loop. You must remain within this activity at least 30 minutes.

READING (RD)

This activity provides access to reading material contained within the RD drawer, and you must remain within this activity at least 30 minutes. When your RD card has been displayed, the drawer will soon unlock and you may remove the reading material. The lounge chair is available during this activity, but be sure to close it before you proceed to another activity. When you want to terminate RD, close the lounge chair and return all materials to the RD drawer.

WORK TWO (WK2)

This activity provides access to the materials contained within the WK2 drawer. When you have selected this activity, follow the instructions that accompany the materials within the drawer. After you have completed the task, place all materials, including the finished product, in the pouch and return it to the WK2 drawer. You may then proceed to the next activity.

PUZZLE ASSEMBLY (PA)

This activity requires you to assemble a puzzle. After you have displayed your PA card, the signal light will soon illuminate. When the signal light illuminates, remove the puzzle and assembly board from the General Charging drawer. The signal light will extinguish automatically sometime later during the activity. Assemble the puzzle on the fold-away table to permit visual documentation of completed work. Position your completed puzzle within the area outlined on your assembly board, and place it within the General Charging drawer. Fully close the drawer before proceeding to another activity.

REQUISITION (REQ)

This activity permits you to earn replacements or additions to various consumable materials used within the environment. Items to be requisitioned are earned by accumulating counts or points on the work counter above the desk. Five hundred responses on the work lever are required to earn one point as displayed on your work counter. Soon after you have displayed your REQ card, the work light on the panel will illuminate. Each time you pull the lever, the light will momentarily dim to provide you with information that the apparatus is operating properly. When you have paused from working for approximately one minute, the work light will extinguish automatically.

You may spend the points you have earned during the Requisition activity. A form will be provided in the General Charging drawer for you to indicate the items that you want to buy. Place the completed requisition form in the General Charging drawer and close the drawer fully. When the requisition item has been delivered, the signal light will illuminate and extinguish sometime later automatically. When the signal light illuminates, you may remove the item from the General Charging drawer. You should keep a record of earnings and expenditures on the note pad adjacent to the work panel. The point costs of the various items available are as follows:

ITEM	COST
Peanuts (can)	20
Cheese & crackers	20
Cookies	15
Orange juice	15
Unknown item	40

You must save the food items earned during REQ and consume them only during a food activity. Once you have selected REQ, you must earn at least one point before you may proceed to another activity, but you may earn no more than twenty points during any single requisition activity.

MANUAL BEHAVIOR (MB)

This activity provides access to the materials contained in the Manual Behavior drawer. Although you may spend as much time as you wish in this activity, you must remain in MB at least 30 minutes. You may keep within your chamber any products that you have made with the materials provided. All other materials must be returned to the drawer when you have finished. You may use the kitchen sink and cleaning materials during this activity.

NEWSPAPER (NWS)

This activity provides access to a current newspaper. You must remain within this activity at least 30 minutes. After you have displayed your NWS card, the signal light will soon illuminate. When the signal light illuminates, remove the newspaper from the General Charging drawer. The signal light will extinguish automatically sometime later during this activity. The lounge chair is available during this activity, but be sure to close it before you proceed to another activity. When you want to terminate NWS, close the lounge chair and return the newspaper to the General Charging drawer.

FOOD TWO (FD2)

This activity allows you to prepare and consume a major meal privately within your chamber. You will not be able to choose the contents of this meal, but examples of foods (mostly frozen main dishes) that will be provided are as follows: chicken, turkey, steak, etc., with appropriate side dishes and beverages. After you have displayed your FD2 card, the signal light will illuminate when the food is available within the food drawer. The signal light will extinguish automatically sometime later during the activity. The stove, refrigerator, and utensils are available, and hot and cold water are available at the kitchen sink for drinking and clean-up during this activity. You may use the lounge chair during this activity, but be sure that the cover is closed before you proceed to the next activity. Also, be certain that all drawers are fully closed before you proceed to the next activity. Although you may save food items delivered during FD2, you may consume them only during a FD1 or FD2 activity. You must remain within this activity at least 30 minutes.

NOT AVAILABLE ON ISOLATION DAY

FOOD THREE (FD3)

To select this activity, display your FD3 card. After a brief delay, the signal light will illuminate, and you may proceed to the social recreation room. Be sure that all doors are fully closed behind you. You may use the bathroom facilities adjacent to the social recreation room, but you may not enter the workshop.

Once you have arrived within the social recreation room, you must remain there for at least 30 minutes before you return to your private room. If other subjects are also in the recreation room and you decide to leave at the same time, you must return to your private rooms one at a time. Of course, you are not required to leave the recreation room at the same time.

In the recreation room, a meal will be available within the FOOD cabinet for each subject selecting FD3.* You may use all facilities within the room including the contents of the GAMES cabinet.

*If you wish to go to the recreation room but do not wish a meal delivered, place your "XX" signs under your FD3 sign, as with FD1.

MUSIC (MU)

Selection of this activity allows you to earn a cassette tape that may be played repeatedly on your tape deck at any time. When the work light goes on after displaying your MU card, you must pull the work lever 2500 times to earn the cassette. Each time you pull the work lever, the light will momentarily dim to provide you with the information that the apparatus is operating properly. The work counter will advance when you have completed the required work. You must place your old tape within the General Charging drawer before a new tape will be delivered. When the first tape or a new tape has been delivered, the signal light will illuminate and extinguish automatically sometime later. When the signal light illuminates, you may remove the tape from the General Charging drawer.

The Music activity allows you to earn the cassette tape. However, it is not necessary to display the MU card to play the tape. If your tape player malfunctions beyond your capacity to repair, it will be repaired automatically later, or a spare machine will be delivered as soon as possible. Once you have selected MU, you must complete 2500 responses and receive the new tape before you may proceed to another activity.

PRIVATE GAMES (PG)

This activity provides access to the materials contained within the Private Games drawer. After you display your PG card, the drawer will soon unlock. To terminate this activity, all materials must be returned to the drawer. You must remain within this activity at least 30 minutes.

NOT AVAILABLE ON ISOLATION DAY

ALLUISI PROGRAM (AP)

To select this activity, display your AP card. After a brief delay, the signal light will illuminate, and you may proceed to the Work Room. Be sure all doors are fully closed behind you. You may use the bathroom facilities adjacent to the Work Room. When you are seated in front of the CRT, the display will appear within 1 to 2 minutes.

Whenever you return to your private room, complete an assessment sheet and point confirmation card, and pass them out the General Charging Drawer.

NOT AVAILABLE ON ISOLATION DAY

COMMUNICATION (COM)

The telephone on the panel above the desk may be used to initiate a communication with the other subject(s) or to receive a communication from the other subject(s).

To initiate or answer a communication, you must first display your COM card over the other activity card on the hook. The telephone operates as follows:

To call the other room or rooms: Lift the telephone from the receiver. The white light will illuminate indicating that the phone is operational. Push and latch down the numbered buttons corresponding to the room or rooms that you wish to call. As long as these numbered buttons are latched down, the white lights will remain illuminated on the corresponding phones. To produce a ring in the rooms you are calling, simply press the R button for as long as you wish the ring to last. The numbered buttons will remain latched down until you hang up the phone. If you call two rooms, the subjects will not know who has called, but either or both of them may answer by selecting COM. If both subjects answer, you may engage in an intercom conference with three subjects.

To answer a call: To answer a call, it is necessary simply to lift your telephone from the receiver once you have entered the COM activity. You will not know who has called until you have answered the phone. Even though you have engaged in a conversation with another subject, it is still possible for either of you to call the third subject. For example, if subjects 1 and 2 are conversing, either 1 or 2 may call subject 3 by latching down button 3 and pressing the ring button. Subject 3 might then join 1 and 2 for a conference

by selecting COM and simply lifting his telephone from the receiver. Of course, all other combinations are possible.

To hang up: To hang up, it is necessary simply to replace your telephone on the receiver. Latched-down numbered buttons will be released, and corresponding call lights within other chambers will be extinguished. Even though you may have discontinued a conversation by hanging up the phone, you continue to have access to the telephone as long as you remain within the COM activity.

AUDIT (A)

You may use the Audit (A) card to learn the daily total each subject has earned. Display the Audit card over the other activity card on the display hook, and the individual totals for that 24-hour period will soon be displayed on the CRT screen. You cannot learn the totals from the previous day (remember that each day starts at 12 noon).

LIMITED TOILET OPERATIONS (LTO)

This activity provides access to the toilet bowl and the hot and cold water at the sink within the bathroom. You may select this activity at any time during the behavioral program. When you display your LTO card, the bathroom door will unlock following a brief delay. Wash-and-dries are available within your Personal Belongings drawer. When you select this activity, place the LTO card over the other activity card on the display hook. When you have completed LTO, romove the card and continue with the activity in which you were previously engaged. The bathroom door will lock automatically after you remove the LTO card from

COFFEE (C)

You may request a cup of coffee at any time during the behavioral program.

In your private room, place your C card over the other activity card on the display hook. Illumination of the signal light will indicate that coffee has been delivered in the food drawer. Remove the C card after the coffee has been delivered.

Please record on the cup lid the time that you actually begin to drink the coffee. Indicate whether you think the coffee is caffeinated (C) or decaffeinated (D) by circling the appropriate letter. When you have finished drinking, return the cup and lid to the food drawer, along with any portion of the coffee you did not drink.

In the social room, display your C card on the numbered display hook located under the clock. Coffee will be delivered in the food cabinet. Remember to remove the C card after the coffee has been delivered. Record on the lid the time that you actually begin to drink the coffee and circle the "C" or "D", then return the cup and lid to the food cabinet when you have finished.

In the work room, display your C card on the numbered display hook located on the bookshelves. Coffee will be delivered through the two-way door. Please wait until you hear the outer door close before removing the cup. Remember to remove the C card after the coffee has been delivered, record the time you actually begin drinking, circle the "C" or "D", and return the cup and lid to the two-way door when you have finished.

URINE COLLECTION

Plastic collection bottles and funnels will be placed in your private chamber--three bottles for each 24-hour period. You are requested to keep the bottles in the small freezer located in the refrigerator in your room. When you hang your TC or LTO sign, the refrigerator as well as the bathroom door will be unlocked. Take out the collection bottle, but please remember to return it to the freezer. The freezer is big enough for three bottles, to be placed next to each other on their side. Be sure the caps are firmly tightened.

Urine collection for each 24-hour period will take place at the start of each new day: 12 NOON. Never pass out bottles until they have been requested by the CRT. In your private room, pass the bottles out the trash chute. In the social/work bath, bottles are to be passed out through the small compartment above and to the right of the toilet tank before you return to your chamber. If all three participants are leaving the work/social area simultaneously, leave the bottles on the bathroom counter. Bottles will be color-coded--a red sticker for S1, a blue sticker for S2, and a green sticker for S3.

If you fill all three bottles before the end of any 24-hour period, please inform us by speaking loudly and clearly to the camera in your chamber. You will then be instructed by the CRT above your desk to pass out the full bottles and new ones will be passed in to you.

APPENDIX A-2

HEALTH ASSESSMENT QUESTIONNAIRES

LOMS SUBJECTIVE STATUS REPORT

Name_____

Below is a list of words or phrases that describe different feelings that people have. Rate yourself on each word or phrase by circling the answer that best describes how you feel now.
BE SURE TO RATE YOURSELF ON EVERY WORD OR PHRASE THE WAY YOU FEEL NOW.

If you feel:
not at all that way, circle 1
a little bit that way, circle 2
quite a bit that way, circle 3
extremely that way, circle 4

T_____ E_____

I_____ A_____

D_____ Co_____

B_____ Ch_____

1.)	CALM	1 2 3 4	30.)	ON EDGE	1 2 3 4
2.)	NERVOUS	1 2 3 4	31.)	CHEERFUL	1 2 3 4
3.)	WEARY	1 2 3 4	32.)	BEWILDERED	1 2 3 4
4.)	FURIOUS	1 2 3 4	33.)	WORN OUT	1 2 3 4
5.)	HOPELESS	1 2 3 4	34.)	COMPOSED	1 2 3 4
6.)	ON TOP OF THE WORLD	1 2 3 4	35.)	RESENTFUL	1 2 3 4
7.)	ACTIVE	1 2 3 4	36.)	GAY	1 2 3 4
8.)	CONFUSED	1 2 3 4	37.)	BLUE	1 2 3 4
9.)	ANXIOUS	1 2 3 4	38.)	READY FOR A FIGHT	1 2 3 4
10.)	TIRED	1 2 3 4	39.)	FORGETFUL	1 2 3 4
11.)	ANNOYED	1 2 3 4	40.)	DISCOURAGED	1 2 3 4
12.)	AT EASE	1 2 3 4	41.)	ALERT	1 2 3 4
13.)	HELPLESS	1 2 3 4	42.)	BAD TEMPERED	1 2 3 4
14.)	LIGHT HEARTED	1 2 3 4	43.)	EXHAUSTED	1 2 3 4
15.)	ENERGETIC	1 2 3 4	44.)	UNTROUBLED	1 2 3 4
16.)	SHAKY	1 2 3 4	45.)	EXCITED	1 2 3 4
17.)	ANGRY	1 2 3 4	46.)	INDIFFERENT	1 2 3 4
18.)	WORTHLESS	1 2 3 4	47.)	HAPPY GO LUCKY	1 2 3 4
19.)	FULL OF PEP	1 2 3 4	48.)	SLUGGISH	1 2 3 4
20.)	CAREFREE	1 2 3 4	49.)	GROUCHY	1 2 3 4
21.)	WORRIED	1 2 3 4	50.)	OPTIMISTIC	1 2 3 4
22.)	UNABLE TO CONCENTRATE	1 2 3 4	51.)	UNCERTAIN ABOUT THINGS	1 2 3 4
23.)	UNHAPPY	1 2 3 4	52.)	VIGOROUS	1 2 3 4
24.)	JITTERY	1 2 3 4	53.)	INEFFICIENT	1 2 3 4
25.)	LONELY	1 2 3 4	54.)	LIVELY	1 2 3 4
26.)	SPITEFUL	1 2 3 4	55.)	CLEAR HEADED	1 2 3 4
27.)	RELAXED	1 2 3 4	56.)	PRETTY GOOD	1 2 3 4
28.)	ELATED	1 2 3 4	57.)	ENTHUSIASTIC	1 2 3 4
29.)	TENSE	1 2 3 4	58.)	TRANQUIL	1 2 3 4

ENVIRONMENTAL QUALITY CHECK LIST

Below is a list of words or phrases that describes certain features or characteristics of the environment. Rate yourself on each word or phrase by finding the answer that best describes the extent to which you have been bothered or distressed by that feature or characteristic since your last health report. Omit items unrelated to this program cycle or experiment.

If you have been bothered...

not at all, circle 1
a little bit, circle 2
quite a bit, circle 3
extremely, circle 4

HEALTH CHECK	1 2 3 4	AUDIT	1 2 3 4
TOILET OPERATIONS	1 2 3 4	LIMITED TOILET OPERATIONS	1 2 3 4
AUTOGENIC BEHAVIOR	1 2 3 4	PROGRAM CONDITION A	1 2 3 4
FOOD 1	1 2 3 4	PROGRAM CONDITION B	1 2 3 4
SLEEP	1 2 3 4	ROOM TEMPERATURE	1 2 3 4
PHYSICAL EXERCISE	1 2 3 4	too hot too cold (circle one)	
WORK 1	1 2 3 4	HUMIDITY	1 2 3 4
ALLUISI PROGRAM	1 2 3 4	too high too low (circle one)	
PRIVATE ARITHMETIC PROBLEMS	1 2 3 4	PRIVATE ROOM SIZE	1 2 3 4
ARITHMETIC PROBLEMS	1 2 3 4	WORK ROOM SIZE	1 2 3 4
GROUP ARITHMETIC PROBLEMS	1 2 3 4	BUGS	1 2 3 4
READING	1 2 3 4	PRIVATE BATHROOM	1 2 3 4
WORK 2	1 2 3 4	COMMON BATHROOM	1 2 3 4
PUZZLE ASSEMBLY	1 2 3 4	OVERHEAD LIGHTS	1 2 3 4
MANUAL BEHAVIOR	1 2 3 4	LIGHTS OUT	1 2 3 4
REQUISITION	1 2 3 4	DICK CHAIR	1 2 3 4
WORK 3	1 2 3 4	CLOCK	1 2 3 4
FOOD 2	1 2 3 4	WALLS	1 2 3 4
FOOD 3	1 2 3 4	DESK	1 2 3 4
MUSIC	1 2 3 4	TABLE	1 2 3 4
PRIVATE GAMES	1 2 3 4	CRT	1 2 3 4
COMMUNICATION	1 2 3 4	CIGARETTE DISPENSER	1 2 3 4

STOVE	1 2 3 4	HALL MIRROR	1 2 3 4
PRIVATE KITCHEN	1 2 3 4	NOISE	1 2 3 4
BED	1 2 3 4	ODORS	1 2 3 4
LOUNGE CHAIR	1 2 3 4	COMMON KITCHEN	1 2 3 4
CURTAIN	1 2 3 4	WASHER AND DRYER	1 2 3 4
VACUUM CLEANER	1 2 3 4	INSTRUCTIONS	1 2 3 4
DRAWERS	1 2 3 4	ISOLATION	1 2 3 4
T. V. CAMERAS	1 2 3 4	EXPERIMENTERS	1 2 3 4
CABINETS	1 2 3 4	REMAINING TIME	1 2 3 4
COOKING UTENSILS	1 2 3 4	SEQUENCE OF ACTIVITIES	1 2 3 4
EATING UTENSILS	1 2 3 4	SUBJECT 1	1 2 3 4
CLEANING MATERIALS	1 2 3 4	SUBJECT 2	1 2 3 4
TRASH DISPOSAL	1 2 3 4	SUBJECT 3	1 2 3 4

TEMPERATURE_____

PULSE_____

WEIGHT_____

RECORD CURRENT TIME_____

Estimate the number of days you could live <u>comfortably</u> in this experiment.

_____More days

SLEEP REPORT

How many minutes did it take you to fall asleep initially? _____

How much difficulty did you have falling asleep initially?

____No difficulty

____Some difficulty

____Quite a bit of difficulty

____Much difficulty

How many times did you wake up during the sleep period other than the time when you terminated the sleep period? _____

GENERAL COMMENTS

PROGRAM EVALUATION FORM

Mark perpendicularly across any part of the line toward the dimension which best describes your feelings concerning the program condition that is now in effect. Note your feelings as they are at the moment.

Program Condition

Extremely positive _____ Extremely negative

SUBJECT EVALUATION FORM

Mark perpendicularly across any part of each line toward the dimension which best describes your feelings toward the other subjects. Note your feelings as they are at the moment.

SUBJECT 1

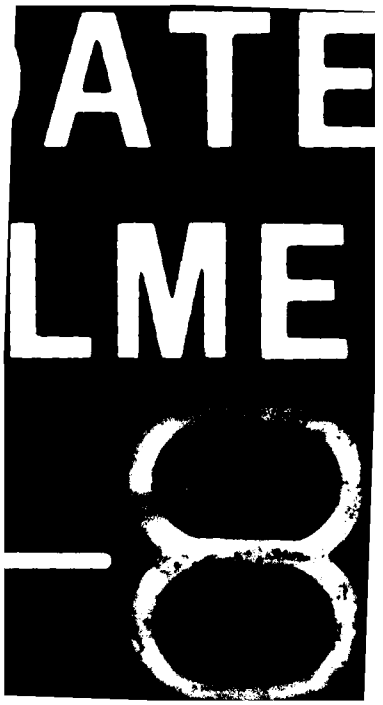
Extremely positive _____ Extremely negative

SUBJECT 2

Extremely positive _____ Extremely negative

SUBJECT 3

Extremely positive _____ Extremely negative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